Competing Economies

AMERICA, EUROPE, AND THE PACIFIC RIM

SUMMARY

CONGRESS OF THE UNITED STATES
OFFICE OF TECHNOLOGY ASSESSMENT

J952-92.

Office of Technology Assessment
Congressional Board of the 102d Congress

GEORGE E. BROWN, JR., *California, Chairman*

TED STEVENS, *Alaska, Vice Chairman*

Senate	House
EDWARD M. KENNEDY *Massachusetts*	JOHN D. DINGELL *Michigan*
ERNEST F. HOLLINGS *South Carolina*	CLARENCE E. MILLER *Ohio*
CLAIBORNE PELL *Rhode Island*	DON SUNDQUIST *Tennessee*
ORRIN G. HATCH *Utah*	AMO HOUGHTON *New York*
CHARLES E. GRASSLEY *Iowa*	*(Vacancy)*

JOHN H. GIBBONS
(Nonvoting)

Advisory Council

CHASE N. PETERSON, *Chairman*
University of Utah
Salt Lake City, Utah

JOSHUA LEDERBERG, *Vice Chairman*
Professor
Rockefeller University
New York, New York

CHARLES A. BOWSHER
Comptroller General of
the United States
Washington, D.C.

LEWIS M. BRANSCOMB
Director of Science, Technology &
Public Policy Program
Albert Pratt Public Service Professor
Harvard JFK School of Government
Cambridge, Massachusetts

MICHEL T. HALBOUTY
Chairman of the Board &
Chief Executive Officer
Michel T. Halbouty Energy Co.
Houston, Texas

NEIL E. HARL
Professor
Department of Economics
Iowa State University
Ames, Iowa

JAMES C. HUNT
Chancellor
Health Sciences Center
University of Tennessee
Memphis, Tennessee

HENRY KOFFLER
President Emeritus
University of Arizona
Tucson, Arizona

MAX LENNON
President
Clemson University
Clemson, South Carolina

JOSEPH E. ROSS
Director
Congressional Research Service
The Library of Congress
Washington, D.C.

JOHN F.M. SIMS
Vice President, Marketing
Usibelli Coal Mine, Inc.
Fairbanks, Alaska

MARINA v.N. WHITMAN
Vice President & Group Executive
Public Affairs Staffs Group
General Motors Corporation
Detroit, Michigan

Director

JOHN H. GIBBONS

The Technology Assessment Board approves the release of this report. The views expressed in this report are not necessarily those of the Board, OTA Advisory Council, or individual members thereof.

Competing Economies

AMERICA, EUROPE, AND THE PACIFIC RIM

SUMMARY

CONGRESS OF THE UNITED STATES
OFFICE OF TECHNOLOGY ASSESSMENT

J 952-92

In Appreciation

H. JOHN HEINZ III
1938 to 1991

The staff of the assessment on Technology, Innovation, and U.S. Trade dedicates this report to Senator John Heinz. Committed to solving the problems of American manufacturing and workers, Senator Heinz contributed to the legislative process an enthusiasm for new ideas and optimism that solutions could be found. He was a requestor of this study and one of the first in Congress to grapple with competitiveness issues. His sense of humor delighted those privileged to work with him, his sense of seriousness made him a strong champion of American manufacturing.

Foreword

Despite macroeconomic adjustments and a lot of discussion, U.S. manufacturing is still in trouble. A test of national competitiveness is whether standards of living improve while world market share holds steady or increases. The United States is failing on both counts. Over the past two decades, the U.S. share of world imports has increased, its share of world exports has decreased, and imports have captured an increasing share of the U.S. market. At the same time, real incomes of the large majority of all Americans have declined.

Studies of specific industries also support the claim that American manufacturing is not keeping up with the competition, the Japanese in particular. While U.S. auto manufacturers have improved in productivity and quality, the Japanese still make more reliable vehicles at lower costs. Japanese computer manufacturers have made rapid progress: even in supercomputers, one of the most advanced sectors, three Japanese firms are now threatening to overtake the U.S. leaders.

Like Japan, Korea and Taiwan have mostly succeeded in promoting development of their economies in general and several advanced industries in particular. We can learn several lessons from these examples. First, the successful governments are partners with the private sector in developing particularly risky technologies and industries. Second, they combine many different policies—including, when necessary, limitations on foreign companies' competition in the domestic market. Third, they patiently persevere with development strategies, often for decades. Finally, they preserve important market disciplines, making sure that domestic companies competed with their most proficient rivals.

This report examines how the economic environment of the United States can be made more conducive to improving manufacturing performance. It considers how Federal institutions, in cooperation with industry, can develop competitiveness strategies for high-tech, fast growing industries; and how trade, financial, and technology policies could be combined into a strategic competitiveness policy.

This is the final report in a series of three in OTA's assessment of Technology, Innovation, and U.S. Trade. The first two reports, *Paying the Bill: Manufacturing and America's Trade Deficit* and *Making Things Better: Competing in Manufacturing*, concluded that there are many signs of weakness in American manufacturing technology and identified policy options to improve the ability of American manufacturers to develop and diffuse technology.

JOHN H. GIBBONS
Director

Advisory Panel—Technology, Innovation and U.S. Trade

Peter J. Sharfman, *Chairman*
Director of Policy Analysis
The MITRE Corp.

Alice Amsden
New School for Social Research
Economics Department

Marietta L. Baba
Professor of Anthropology and Acting Chair
Wayne State University

Wolfgang Demisch
Managing Director, Director of Research
UBS Securities

Jean-Jacques Duby
Group Director, Science and Technology
IBM - Europe
Paris LaDefense, France

Mark Eaton
Director, International and Associated Programs
Microelectronics & Computer Technology Corp.

John T. Eby
Executive Director, Corporate Strategy
Ford Motor Co.

Larry French
Consultant

Glen S. Fukushima
Director, Public Policy and Business Development
AT&T Japan Ltd.
Tokyo, Japan

Edward Graham
Research Fellow
Institute for International Economics

Joseph A. Greenwald
Attorney/Consultant

Howard Greis
President
Kinefac Corp.

Peter Hall
Professor of Government
Harvard University

F. William Hawley
Director, Governmental Relations for
International Affairs
Citicorp

Sanford Kane
President and CEO
PCO, Inc.

Robert Kuttner
Economics Correspondent
The New Republic

Alek A. Mikolajczak
Vice President, Technology and New Business
Rohr Industries

Susan Pharr
Professor of Government and Director,
U.S.-Japan Relations Program
Harvard University

Margaret Sharp
Senior Research Fellow
Science Policy Research Unit
University of Sussex
East Sussex, England

Laura Tyson
Professor of Economics
University of California, Berkeley

John D. Warner
Vice President, Engineering
Boeing Commercial Airplane Group

Stephen Woolcock
Fellow
Royal Institute for International Affairs
London, England

NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The panel does not, however, necessarily approve, disapprove, or endorse this report. OTA assumes full responsibility for the report and the accuracy of its contents.

OTA Project Staff—Competing Economies: America, Europe, and the Pacific Rim

Lionel S. Johns, *Assistant Director, OTA*
Energy, Materials, and International Security Division

Audrey B. Buyrn, *Program Manager*
Industry, Technology, and Employment Program

Julie Fox Gorte, *Project Director*

Katherine Gillman, *Deputy Project Director*

Robert Weissler, *Senior Analyst*

John Alic George Eberstadt Robin Gaster

Sebastian Remoy Robert Wade

Elizabeth Sheley, *Editor*

Administrative Staff

Carol A. Guntow, *Office Administrator*

Christopher N. Clary, *Office Administrator*[1]

Diane D. White, *Administrative Secretary*

Publishing Staff

Kathie Boss, *Publishing Officer*

Cheryl Davis Dorinda Edmondson Denise Felix Steve Kettler[2]

Chip Moore Christine Onrubia Susan Zimmerman

Contractors

Marie Anchordoguy
BSI Consulting, Inc.
Stephan Haggard
Keith Hayward
Hugo Letiche
Takashi Mashiko
Todd Watkins
James Womack and Daniel Jones

[1]Until June 1990.
[2]Until September 1991.

CONTENTS

	Page
THE COMPETITIVENESS PROBLEM	1
The Role of Competition: Are Free Markets Always Best?	5
Industrial Targeting	7
Import Dependence	9
SUMMARY OF POLICY ISSUES AND OPTIONS	11
Institutions for a Strategic Competitiveness Policy	13
A Technology-Friendly Environment	14
Trade Policy Options	18
GOVERNMENT-INDUSTRY PARTNERSHIPS	21
Risk Sharing in Technology Development	21
Financial Risk-Sharing	23
Government Purchases	23
AMERICAN FIRMS, FOREIGN FIRMS, AND AMERICAN INTERESTS	24
U.S. TRADE POLICY	26
EUROPE AND THE SINGLE MARKET	28
JAPAN	29
INDUSTRIAL POLICIES IN TAIWAN AND KOREA	31
GOVERNMENT SUPPORT OF LARGE COMMERCIAL AIRCRAFT	32

Figures

Figure	*Page*
1. U.S. Imports as a Percent of GNP	2
2. Merchandise Trade Balance, Percent of GNP	2
3. Real Hourly Wages, Manufacturing: 1982-84 dollars	2
4. Weekly Wages, Manufacturing: 1982-84 dollars	3
5. Weekly Wages and Salaries of Full-Time Employees, 1969-90, 1982-84 dollars	3
6. Japanese Share of World Trade	4
7. Imports as a Percent of GNP, Japan	4
8. Trade Balances as a Percent of GNP, Japan	4

Table

Table	*Page*
1. U.S. Share of World Imports and Exports	1

THE COMPETITIVENESS PROBLEM

U.S. manufacturing is falling behind the competition. The standard of comparison is Japan; if Japanese companies were not such successful competitors in many important industries, America's competitiveness problem would be far smaller. Eventually, other East Asian nations like Korea and Taiwan probably will rival Japan as top international competitors, and the European Community is trying to improve its own competitiveness. But for now, it is Japanese industry that poses the most formidable challenge.

What is the evidence that American manufacturing has lost competitiveness? There is no widely accepted single measure of competitiveness. Analysts use many proxies: international trade balances, comparative international figures on productivity or standards of living, manufacturing's share of gross national product (GNP), and comparative studies of the performance of individual industries are common ones. However, examining U.S. performance piecemeal in a few of these areas does not give a consistent picture. So, despite growing acceptance of the notion that U.S. manufacturing is in competitive trouble, the debate persists.

A logical way to sort out the usefulness of these measures is to begin with a definition of competitiveness. One that stands out as being most useful is defined in the 1985 report of the President's Commission on Industrial Competitiveness:

> *Competitiveness is the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens.*

There are two pertinent criteria here: meeting the test of international markets, and maintaining or expanding real incomes. Free and fair market conditions is a qualifier. We shall consider these items one by one.

The most obvious way to interpret "meeting the test of international markets" is in terms of world market share. There is no direct, single measure of U.S. manufactured goods as a share of global manufacturing output, but if we combine data on U.S. shares of world imports and exports with figures on the proportion of U.S.-made goods in domestic consumption, the picture that emerges is unequivocal: the United States has lost world market share in merchandise.[1] The U.S. share of world merchandise imports has climbed from less than 15 percent in 1968 to over 17 percent in 1988; its share of world merchandise exports has fallen from nearly 16 percent to less than 13 percent over the same period (table 1).[2] At the same time, imports captured an increasing share of the U.S. domestic market, going from about 3 percent of GNP in 1960 to over 9 percent in 1989 (figures 1 and 2).

To be sure, it was natural and expected for the United States to lose market share as the world's developing and war-torn economies improved their performance. Sinking market share alone is not proof of failing competitiveness. Had Americans become better off in the process of producing a smaller share of world output and domestic consumption, competitiveness would not be the issue it is now.

If American manufacturing had stayed robustly competitive, we would expect to see the living standards of manufacturing workers increase. Instead, they have plummeted. Real hourly wages of manufacturing production workers peaked in 1978 at almost $9.50 per hour;[3] by 1990, they had sunk to almost $8.00, below the 1964 level (figure 3). Real weekly wages of manufacturing workers also

Table 1—U.S. Share of World Imports and Exports

Year	Percent of imports	Percent of exports
1970	12.9	13.8
1973	12.4	12.4
1975	11.7	12.7
1977	13.6	10.8
1978	13.8	11.1
1979	13.1	11.1
1980	12.5	11.1
1981	13.4	11.9
1982	13.4	11.6
1983	14.4	11.1
1984	17.2	11.5
1985	17.9	11.1
1986	17.5	10.3

SOURCE: United Nations, Department of International and Social Affairs, *1985/86 Statistical Yearbook*, 35th Issue (New York, NY: United Nations, 1988).

Figure 1—U.S. Imports as a Percent of GNP

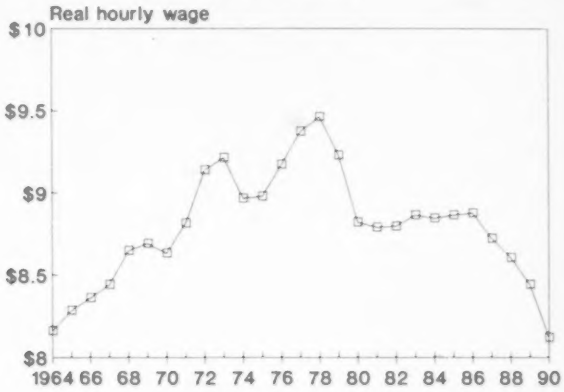
SOURCE: *Economic Report of the President*, (Washington, DC: U.S. Government Printing Office, February 1990), table C-1; and U.S. Department of Commerce, Bureau of Economic Analysis, "International Transactions," *Survey of Current Business*, June 1991.

Figure 2—Merchandise Trade Balance, Percent of GNP

SOURCE: *Economic Report of the President* (Washington, DC: U.S. Government Printing Office, February 1990), table C-1; and U.S. Department of Commerce, Bureau of Economic Analysis, "International Transactions," *Survey of Current Business*, June 1991.

peaked in the late 1970s, but have since fallen to levels of the late sixties (figure 4).[4] Looking more broadly at the workforce does not improve the picture. Real hourly and real weekly wages of all production and nonsupervisory workers—over 74 million people by the end of 1989, or 63 percent of the employed civilian workforce—have been sinking too. After peaking in 1972, real hourly wages dropped back to where they were in the mid-sixties, and real weekly wages declined much further. A still broader measure of living standards is wages and

Figure 3—Real Hourly Wages, Manufacturing: 1982-84 dollars



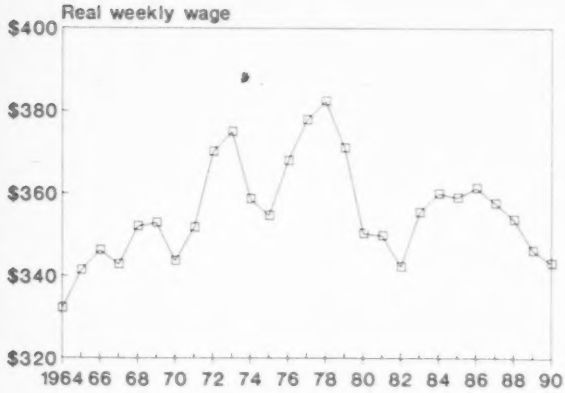
SOURCE: U.S. Department of Labor Statistics, *Employment and Earnings*, various issues.

salaries of all full-time workers (73 percent of the workforce). Here, too, are losses: real weekly wages were about $330 in 1969, and below $320 in 1990, and have been falling since 1987 (figure 5). In sum, the living standards of the large majority of all Americans have dropped.

So U.S. manufacturing fails the test of improving competitiveness on two counts: decisively on meeting the test of international markets, and substantially on increasing standards of living. Have these happened under conditions of free and fair markets? Here, the evidence is not conclusive. While markets have grown more free over the postwar period in terms of the general level of tariffs and quotas, many analysts would argue that nontariff barriers have proliferated. Whether the overall effect is one of increasing market openness, at least for a majority of our largest trading partners, is unproven.

There is another way of looking at this issue. The only explanation of U.S. losses of world market share in merchandise and losses of real income for the majority of Americans *other than* a drop in competitiveness would be a substantial, progressive closure of international markets. Furthermore, we would also have to make a case that a broad array of American industries needed access to other big markets (Canada, Japan, and Europe) in order to maintain competitiveness. While there are some products for which increasing returns to scale make efficient-sized enterprises too large for all but global markets, for example, large commercial aircraft and supercomputers, it is hard to argue that the U.S.

Figure 4—Weekly Wages, Manufacturing: 1982-84 dollars



SOURCE: U.S. Department of Labor Statistics, *Employment and Earnings*, various issues.

Figure 5—Weekly Wages and Salaries of Full-Time Employees, 1969-90, 1982-84 dollars

SOURCE: U.S. Department of Labor Statistics, *Employment and Earnings*, various issues.

market is too small to support competitive industries in most of manufacturing. In view of what is known about decreasing formal trade barriers, the burden of proof is on anyone who would argue that market closure accounts for the drops in American world market share and standards of living since the 1970s.

This does not mean that every American industry is uncompetitive or is growing less competitive. In fact, competitiveness is best understood at the level of industries and even companies. What these figures tell us is that, at least in the most important sectors, U.S. companies are not holding their own against foreign competition. In particular, American industries are beleaguered by Japanese competitors.

Japan's record over the postwar period is in many ways a mirror image of America's. Japan's share of world exports increased 3 percent per year between 1968 and 1988, while its share of world imports increased 0.8 percent annually (figure 6). Japanese companies also held their own in their home market (figures 7 and 8).

At the same time, Japan has been able to sustain brisk growth in living standards compared with the rest of the developed world. Real gross domestic product (GDP) per capita rose an average of 6 percent per year between 1950 and 1989, faster than in any other developed nation (the United States averaged only 1.9 percent per year, and Western European countries between 2 and 3.5 percent). To be more accurate, Japan in the 1950s may have fit more into the category of developing than developed nation, and therefore had more potential for very rapid growth. But even after this development period, Japan's growth in real GDP per capita was higher than that of any other developed nation between 1979 and 1989 as well, averaging 3.5 percent per year, about double the rate of most European countries and the United States.[5] Real earnings per employee in manufacturing increased 3.6 percent per year, on average, between 1968 and 1985, and gross national income per capita went from 55 percent of U.S. levels in 1968 to 88 percent two decades later.[6] While citizens in the United States still earn more and live better than citizens of Japan, most Americans are not becoming better off, and most Japanese are.

The complication in comparing the records of the two countries comes in the caveat "free and fair market conditions." Japan's market was anything but open in the early postwar decades. Due to a combination of business practices and government policies, it is still one of the world's most difficult markets to penetrate. Under these conditions, it is not surprising that Japan's companies did well in their domestic market, or conversely, that manufactured imports did so poorly. But while this lack of permeability kept Japan's people from consuming as much or living as well as they would have with the same income in the United States, it is also true that Japanese companies in many industries did meet the test of international competition in the more open

Figure 6—Japanese Share of World Trade

SOURCE: *Economic Report of the President*, (Washington, DC: U.S. Government Printing Office, February 1990), table C-1; and U.S. Department of Commerce, Bureau of Economic Analysis, "International Transactions," *Survey of Current Business*, June 1991.

Figure 7—Imports as a Percent of GNP, Japan

SOURCE: Organization for Economic Cooperation and Development, Department of Economics and Statistics, *National Accounts*, various issues.

Figure 8—Trade Balance as a Percent of GNP, Japan

SOURCE: Organization for Economic Cooperation and Development, Department of Economics and Statistics, *National Accounts*, various issues.

markets of the United States, Canada, and Western Europe.

In fact, there are other conditions that affect competitive performance. Currency value is an important one. In the early 1980s, the high value of the dollar was widely held to be primarily responsible for the nation's plunge into deep trade deficits, and conversely, the falling dollar in the late 1980s for the improvement in the trade accounts. But over the long run, adding currency value into the picture simply accentuates the difference in competitive performance of American and Japanese manufacturers; American manufactured goods have lost world market share in spite of the fact that the dollar has been on a long-term decline against a trade-weighted

average of foreign currencies. Japan's manufacturers have increased their market shares even with a rising yen.

American manufacturers are aware of their competitiveness problems; many have made commendable efforts to improve their performance. But particularly in sectors that contribute heavily to employment, trade, knowledge, and income, there is still a gulf between Japanese and American company performance. In many cases, the gap is widening, driven by the fact that Japanese companies, flush with the profits of their market success, are investing more heavily in technological improvement and global expansion. *If there are no major changes in government policies of developed nations, we expect U.S. manufacturing competitiveness to continue to sink, compared with Japan.* There will be more emerging technologies in which the dominant power is Japan, not the United States, and established industries will remain behind the Japanese world leaders. This situation also faces producers in Western Europe, who are likewise behind the Japanese (and in some cases American) manufacturers in a variety of important sectors. The difference between the United States and Europe, at this point, is that European governments are taking an active role in trying to bolster their competitiveness, while the U.S. Government takes the position that the best aid to competitiveness is a free market.

The Role of Competition: Are Free Markets Always Best?

Market freedom is a relative thing. By the standards of economics, there is no free market in the world today, and there never was. There are, on the other hand, quite a number of economies whose markets are thought of as free because large segments of the economy are shaped at least as much by market forces as by policy and regulation. The United States likes to think of itself as one of the most free markets, and it probably is. That, plus the fact that the United States has been the dominant economic power of the world throughout the postwar period, is often taken as proof that the market is superior to government planning as the way to economic prosperity. The recent events in Eastern Europe, with the demonstrated failure of heavy state planning, are regarded as additional confirmation.

In fact, both government and the market are, in the words of one eminent economist, instruments of social policy.[7] They are different ways of arranging the activities of production and distribution in the economy; neither is clearly superior to the other. We do not really know what the economy would look like if markets were not limited and constrained in countless ways by government regulation, but one hypothesis is this:

> The only industry that knows no bounds or rules is the illicit drug trade, where the market process resembles what Thomas Hobbes called the "Warre of Each Against." He described life under those conditions as "Nasty, Brutish and Short."[8]

The miserable record of the command and control economies of Eastern Europe, compared with the record of the U.S. and Western European economies, does not imply wholesale superiority of market forces under all conditions. Most of the restraints the U.S. and other governments impose on markets exist because the market serves some interests (e.g., long-term values of society or provision of social goods like scientific knowledge, clean air, and safety for poor people) very poorly. If we examine the difference between the performance of Japan and the United States, it is appropriate to suspect that more competition is not always better.

The government of Japan has never been as sold on the tenets of neoclassical economics as the government of the United States. Japan and the fast developing East Asian economies of South Korea and Taiwan have restrained and shaped competition at various points in modern history and have benefited as a result.[9] One of the most visible forms of restraint on free markets is the market protection that all three countries have used extensively to nurture infant industries and, in a few cases, to permit orderly rationalization of mature ones.[10] Japan employs government intervention to harness, channel, or restrain the forces of competition. During the 1960s, the government coped with what it called "excessive competition" by organizing antirecession cartels and vigorous export campaigns, erecting barriers to foreign direct investment, and structuring the financial system to favor industrial investments (especially in targeted industries) over consumption.[11] These measures were aimed at both restraining competition from more advanced foreign firms and restricting the cutthroat investment and price competition among Japanese firms.[12] Starting in the 1980s, the government still reined in competitive forces, but with different

measures (e.g., voluntary restraints on exports and bargains to increase foreign firms' access to the Japanese market) and for a different purpose: to soften foreign, often U.S., complaints of unfair competition. Although the forms and aims are new, the effect is still an interference with the workings of the market.

The Japanese Government has never trusted the market to achieve, by itself, large-scale investments for basic research in high technology, or to overcome the disadvantages of being behind.[13] In this, Japan is hardly alone. Few developing nations trust market signals alone to generate the investments and provide the resources necessary to improve industrial development and living standards. Korea and Taiwan, too, have altered market signals and outcomes significantly. Both share a commitment to long-term planning, industrial targeting, or strategic visions—forcing their firms to compete on world markets and nurturing them at home. Taiwan, while more open to foreign trade than Korea, and with less interventionist industrial policies, has relied more on public enterprises. Korea has been more protected from foreign competition, with the protection tied to export expansion. Both countries depend on government policies to promote an indigenous technology base. (See ch. 7 of the full report for discussion of the industrial policies of Korea and Taiwan.)

Japan, Korea, and Taiwan all developed exceptionally fast, with industrial policies that significantly altered, but did not destroy, market signals. Protection of the domestic market and direct funding of R&D were forms of intervention, as were policies to steer low-cost capital, preferential access to foreign exchange, assistance in negotiations with foreign companies for access to technologies, and support of domestic technology development and implementation through a variety of fiscal incentives. At the same time, these governments were careful to maintain incentives that forced domestic firms to compete with the dominant foreigners, often in third markets or in the home markets of the foreign competitors. Market competition, in short, was viewed as having a proper place; it was superior to government planning in providing incentives to improve productivity and quality and reduce costs. But unbridled competition was not, and still is not, regarded as always yielding the best possible outcome for the nation.

The prevailing ideology in the United States is very different. We have accepted that market competition will not secure the outcome we want in some areas. For example, market incentives do not provide sufficient incentives to invest in as much R&D as would be optimal for the nation, nor do they provide incentives to preserve such public goods as clean air and water. But the United States views anything less than free trade as dangerous interference. This is consistent with the ideology of the great European powers when they were the highest value, lowest cost, most advanced producers of their day; it is nothing new for the prevailing economic view to coincide with commercial interests.[14] But the fit between the two, never perfect, is growing more uncomfortable as U.S. industries watch foreign competitors, usually Japanese, attain technological dominance in many important industries. More U.S. industries are finding themselves in the position of having to catch up, while learning that intelligent responses to market signals are insufficient to close the gap between them and the market leaders.

A case in point is capital cost. Throughout most of the postwar period, as a result of government control of financial markets, Japanese and German companies have enjoyed much lower capital costs for plant and equipment acquisition and R&D than American firms. As a result, they have invested more in R&D, plants, and equipment, and been more patient in recouping those investments. The responses have been especially strong in industries that demand high investments in R&D and capital equipment. In Japan, special tax measures, such as accelerated depreciation, have sweetened the investment incentives in particular industries chosen by the government as strategic. As a result of these and other measures, Japanese firms invested more in technology development and adoption than American firms and have advanced faster and gained greater market shares.[15]

What the Japanese Government, and more recently the Korean and Taiwanese Governments, has done is to use a combination of market signals and government planning to speed economic development and growth. At times, the interventions have backfired, but overall, the policies of the Japanese, Korean, and Taiwanese Governments have been essential to fast development. They are not the *only* contributors, as shown by the failure of similar government policies to lift dozens of other less

developed countries out of poverty. What sets these East Asian nations apart?

Some of the answer, of course, is that they *have* relied heavily on market forces to shape the behavior and strategy of businesses. Many developing and some developed nations have erred in the direction of overprotection, and protected sectors have failed to become competitive with world leaders. The successes of the East Asian nations lie in their combination of import substitution and market protection with export promotion, which allowed domestic industries some potential for output growth and access to needed equipment and components while forcing them to compete with the best performers in the world.[16] The governments were able to force or influence firms to conform with public policies through a variety of disciplinary measures. Firms that failed to improve export performance, for example, might have trouble getting the necessary permission and foreign exchange to import needed equipment.

Another part of the explanation is that the companies crafted intelligent, patient strategies for developing, producing, and marketing their products. Some of this strategic genius is attributable to government policies and some to good business strategies, but another part is sheer diligence; East Asian companies are famous for scouting and adopting the best of the strategies of other successful companies and countries. Policies and cultures that emphasized very high product quality and universal education also helped, as did ethics that valued hard work. Industrial policies were not the whole answer, but the path of development would have been slower and rockier without them.

Industrial Targeting

To Americans, industrial targeting is one of the most controversial aspects of industrial policy. The idea that some industries contribute more to national well-being and knowledge than others is not particularly contentious. It is other things in targeting that we fear. One is that government will not be rational in its choice of industries to support and that the process will end up being hijacked by special interests. Another objection is that the market is better suited than government to choose the industries that make disproportionately large contributions to national welfare.

Most developed nations and many developing ones do not share that faith in the market. The Japanese Government considers certain industries crucial to its economic health. Immediately after the war, policymakers felt that Japan should be strong in manufacturing iron and steel, ships, machinery, heavy electrical equipment, and chemicals. Later, the automobile, petrochemical, nuclear power, computer and semiconductor, and aircraft industries were added to the list.[17] Though less so than in the 1950s and 1960s, Japan continues to provide particular benefits to targeted industries and the users of their outputs.[18] Korea and Taiwan, too, selected industries for special support. In the 1950s, Korean industrial policy focused on import substitution in light manufacturing. In the late 1960s, emphasis shifted to steel and nonferrous metals, chemicals and petrochemicals, machinery, automobiles, and shipbuilding. Still later came emphasis on semiconductors, computers, and consumer electronics. The pattern in Taiwan was similar, emphasizing light manufacturing and import substitution in the first two postwar decades, shifting to heavy industries in the 1960s and later into more technology-intensive sectors. The tools and methods were different, but the selection of industries was similar.

Industrial targeting is not limited to developing countries. Most of the nations of the European Community (EC) have long had policies of supporting European producers of motor vehicles, telecommunications equipment, semiconductors, consumer electronics, and aircraft. While now discouraging support for national champions by individual countries, the EC's plans for the single market in 1992 and the Framework Program and EUREKA[19] are aimed at developing technological and productive prowess in many of the same sectors. Electronics and telecommunications sectors receive greatest emphasis and heaviest support in European R&D programs, while EC trade policies are being structured to cushion the European automakers' encounters with Japanese producers.

Even in the United States, which has mostly rejected the use of policies designed specifically to improve civilian industrial competitiveness,[20] there are a few examples of industrial support for nonmilitary purposes. One of the most prominent is the National Aeronautics and Space Administration (NASA), which has, as part of its mission, the responsibility of improving aircraft technology.[21] NASA's Aeronautics Program budget in 1991 was

almost $920 million;[22] in 1992, the budget is expected to exceed $1 billion.[23] Though this is partly intended to support military technologies, NASA officials state that 90 percent of the technology developed is common to both military and civilian needs.

That industrial targeting exists is not a question. But can the U.S. Government select the right industries for support? To detractors, the idea of "picking winners" is dangerous because it opens the possibility that any industry could be selected if it had a powerful enough lobby. Another potential drawback is the argument raised by many economists, that industrial supports could skew investment incentives and create excess capacity, and thus increase vulnerability to business cycles in targeted industries. This, in turn, could make additional protective measures necessary—beginning a cycle of ever-widening support, at increasing cost to taxpayers and diminishing benefit to consumers. These are real problems and should be taken seriously, but they are not the inevitable outcome of any exercise in supporting the competitiveness of critical industries. Japan, Korea, and Taiwan have had some problems resulting from their support of targeted industries, but their overall economic performance—and, with few exceptions, the performance of the targeted sectors—has been better than that of the United States. Some argue that the success of these economies, and of targeted industries, is more coincidental with industrial policy than causally related. But after weighing the evidence, OTA concludes that the industrial policies of these East Asian countries is crucial in their economic performance.

Japanese industrial policy aimed at changing Japan's industrial structure from one characterized by labor-intensive industries immediately after the war to one dominated by capital-intensive industries in the 1950s and 1960s, and from that to one led by knowledge-intensive industries from the 1970s to the present. At each stage of policy formulation, industries selected for special support were those that made disproportionately large contributions to national well-being.[24] They had high growth prospects, higher wages, and the possibility of higher profits, with more positive spillovers to other sectors in terms of contributions to technology and knowledge. In some cases, the spillovers were downstream: microelectronics and computers add to the technology intensity and productivity of industries that employ them. In the case of automobiles, primarily a consumer product, the contributions to other industries came primarily upstream, in the machinery industry.

The idea that certain sectors can be identified as incubators of larger economic change is gaining currency in the United States as well. An economy with strength in these industries will have higher wages, faster growth, and better developed processes of generating, diffusing, and using new technology than economies that do not. It is no coincidence that many of these industries—e.g., semiconductors, computers, telecommunications equipment, aircraft and spacecraft, and advanced materials—also present formidable barriers to entry. Capital requirements for efficient production are often quite high, and the requisite knowledge of science, technology, and production is even more forbidding. If government can help potential entrants overcome entry barriers, the whole economy can be put on a path of faster growth and higher incomes.

With most of the governments of large developed economies providing some kind of support for critical industries, the market signals American firms get for these same industries often point in the opposite direction—down. In many critical, high-technology sectors, American firms are facing competitors whose business risks are shared by their governments (and thereby, the taxpayers of their home nations). Faced with the necessity of assuming most of the risks and costs of entering or even maintaining operations under such conditions, some eventually abandon operations, as have many American manufacturers of memory chips.

Can the U.S. Government afford to be indifferent to the mix of industrial goods produced here? It would be dangerous, and in many ways unprecedented, to adopt this course. While we have let a few industries, such as consumer electronics, wither in the face of superior foreign competition, the government has stepped in many times to support industries that served various economic needs, including employment (the Chrysler bailout), technology development (aircraft in the 1920s and 1930s), and national/economic security (semiconductors). This is not meant to imply that every effort to develop or support an industry has been successful; every country that has tried industrial support has made some errors. In many developing nations, the whole enterprise of supporting industrial development has

been disastrous; government planning cannot replace the market and the forces of competition. But the signals the market sends to American firms in the majority of high-technology, economically critical industries are not promising if we want those industries to thrive financially and technologically. It is equally dangerous to trust ad hoc, often crisis-motivated, efforts to intervene in industrial structure and performance and expect the results to make consistently positive contributions to economic well-being.

Import Dependence

One of the biggest problems in sorting out how to treat critical industries in public policy is choosing among them. All nations do not have to, and indeed, cannot, be competitive in all high-technology industries or critical sectors, if only because some, such as aircraft, will not support more than a few competitors without massive government assistance. Moreover, there are many sectors regarded as critical, and self-sufficiency in all of them may be beyond the means of any single nation, or it might spread available resources for support too thinly to have an impact. Finally, and most importantly, self-sufficiency bypasses the benefits of specialization and trade.

It should do a nation no harm to import certain critical products and export others. This is how Germany manages, and the Germans have the highest standards of living and most competitive manufacturing in Europe. Manufactured imports accounted for 14.4 percent of German GDP in 1987, and for nearly 45 percent of German manufacturing GDP. In the United States, manufactured imports were 7.3 percent of GDP and 37.8 percent of manufacturing GDP; corresponding figures for Japan (which is an outlier among both industrialized and industrializing nations) are 2.4 and 8.3 percent.[25]

This kind of evidence often leads some to question why the United States should care about depending on foreign manufacturers, even for key inputs. In fact, competitiveness might be improved as a result; computer manufacturers could be more competitive if they have access to low-cost foreign semiconductors than if they have to pay higher prices for domestically made ones. Certainly, after the 1986 Semiconductor Trade Agreement (STA) with Japan resulted in (though did not necessarily cause) high prices for 256K DRAMs, American computer makers suffered declines in profitability, and Japanese computer makers improved market positions and profits.[26] In fact, the fallout of the STA is often used to support the argument that trade protection hurts more than it helps. Whether that is true, even in the one case of the STA, is disputed.

The STA was signed after several years of mounting disputes with Japan over the fairness of their trade in semiconductors.[27] American producers alleged that Japanese semiconductors were dumped, both in the United States and in third country markets, and that American semiconductor chips were unfairly excluded from Japanese markets. After formal investigation, the International Trade Administration found that dumping charges were substantiated. The STA stipulated that both practices (dumping and exclusion) should stop.[28] American officials apparently hoped for substantial cutbacks in Japanese production as a means to raise prices of Japanese semiconductors, thus ending the dumping. Shortly after the STA was signed, MITI (the Japanese Ministry of International Trade and Industry) took to issuing "forecasts" of chip production that were widely interpreted, here and in Japan, as administrative guidance to cut production. The companies, however, were initially unresponsive, and the U.S. Government announced sanctions in early 1987.

Others dispute that the STA caused Japanese producers to raise prices.[29] According to the counter argument, joint action by Japanese producers was underway for at least a year before the STA was concluded, and had begun before the STA was even a topic of discussion. The collapse of DRAM prices in 1984-85 that precipitated the withdrawal of many non-Japanese producers from the market also cost Japanese producers billions of dollars. By late 1985, the market was dominated by Japanese producers. Newspaper accounts about Japanese companies taking joint action to raise DRAM prices began to appear in 1985, as did rumors of meetings of Japanese producers aimed at addressing "the price disaster." These stories and rumors are made more believable by the many instances of coordinated Japanese industry/government management of prices and production that occurred in other industries (e.g., iron and steel) in the past.

Both sides of the story agree on one point: that MITI's forecasts and guideposts are used as targets for production and/or prices. The difference arises

over whether the production cutbacks and price increases, which both sides agree were deliberate, were a result of the STA. Without a formal investigation, the dispute will likely remain unresolved.

Whether or not U.S. sanctions were an important cause, the fact remains that by early 1988 prices of Japanese DRAM chips rose, and production fell, a sharp break with past price behavior. While MITI denies any official guidance, its continued quarterly forecasts and their pinpoint accuracy strongly suggest to some analysts that MITI was controlling production and, possibly more significantly, investment in new facilities. Ordinarily, sustained high profits brought on by elevated prices would be expected to generate a wave of investment in new capacity, which, as of mid-1989, had not materialized, in contrast to the past and contrary to what analysts expected.

Some of the restraint in investment in new capacity was attributed to quiet guidance by MITI, and some to a new "spirit of cooperation" among the Japanese DRAM manufacturers. Both can be attributed in part to fears of reigniting trade disputes with the United States, but there was something else at work, too. The Japanese producers, probably with MITI's encouragement, had begun to act like a cartel, controlling output and prices and reaping higher profits as a result. While that was a predictable outcome of the U.S.-initiated STA and accompanying sanctions, it is one of the more ominous developments on the trade scene, and it symbolizes one of the things most feared about dependence on foreign suppliers. When suppliers act collusively to manipulate production and prices, everyone else is stuck paying higher prices. If the products of the cartels are inputs to key industries, whole economies can suffer. No nation is more aware of this than Japan, which suffered a severe economic downturn after the first oil shock in 1974.

But how much real danger is there? Cartels that can effectively manipulate supplies and prices globally are not very common. It is tempting to think that if we don't meddle with free trade we won't have a problem. But this is probably wishful thinking. Japan maintains several legal cartels, and while the number is diminishing the practice is familiar. Moreover, the historical links between the semiconductor companies and the Japanese Government mean that under ordinary circumstances they share a degree of knowledge of each other's plans and behavior that would be considered extraordinary, probably collusive, in the United States. Even without the prodding of the STA, it is conceivable that Japanese companies might have begun to exercise restraint over production and prices. Two pieces of evidence support the notion that these producers were amenable to such restraints. One is the fact that similar price rises did not occur in EPROMs (erasable programmable read-only memories), another semiconductor product covered in the STA. Unlike the situation in DRAMs, production of EPROMs was not dominated by a few Japanese companies. Another is the difference in the degree of compliance with STA in two areas: dumping and foreign companies' share of the Japanese market. Cutbacks in production resulted in price increases that eliminated dumping in fairly short order, while the share of foreign semiconductors in Japan's market has increased much more slowly than originally called for.[30] It took much less time and effort to arrange production cutbacks, which resulted in higher profits for Japanese companies, than increased market share for foreign companies, which gave Japanese companies no particular benefits.

Another problem created by dependence on one or a few suppliers for critical components is access to the latest technologies. Again, under the conditions of competition envisioned in economics, a supplier of critical components would be foolish to deny the most advanced products to any customer, since a competitor is always ready to do it. For example, the world's industrial producers of textiles depend on machinery from a handful of suppliers in a few countries—Germany, Switzerland, Japan, Italy, and Sweden account for most of it. Yet textile manufacturers are routinely able to get the most advanced equipment from any supplier; textile makers in the countries that manufacture textile production equipment have no particular advantage. The story is different in electronics.

American and European systems makers, or policymakers speaking on their behalf, are concerned that it may be difficult to get the most advanced production equipment or chips from Japanese vendors. In most cases, those Japanese vendors are also systems makers, or else they have close ties through the *keiretsu*[31] system with a Japanese systems maker. It is a logical, and probably not uncommon, business practice to reserve access to the latest technologies to users within the develop-

ing firm or to special customers. According to anecdotes, when IBM and Perkin-Elmer had a special relationship, IBM got first access to new machinery developed by Perkin-Elmer. While no blame attaches to Japanese companies that give themselves or their closest customers first crack at new generations of technology, the competitive advantage it confers on Japanese firms can be significant in the fast-moving electronics industry.

Dependence on imports, particularly when those imports come from only a few suppliers, and particularly when those suppliers are also competitors, can create vulnerabilities that nations sometimes choose to avoid. Four European countries, for example, continue to provide financial support to Airbus in part because they do not wish to depend on two American companies, Boeing and McDonnell Douglas, for all large commercial jet transports. While Airbus is a financial drain on its government sponsors, it has forced the American producers to compete on price to a greater extent. Probably the foremost example of unwillingness to rely on foreign suppliers is Japan, which has a long tradition of limiting dependence on imports to a practical minimum.[32] While Japan is criticized for its peculiarly strong aversion to imports, and is slowly changing, many of Japan's premier industries probably would not have developed, or would have developed far more slowly, had it permitted much greater imports and investment when Japanese industries were catching up. Now, with an increasing number of American industries in the position of latecomer, the vulnerabilities created by import dependence have assumed more importance.

SUMMARY OF POLICY ISSUES AND OPTIONS

The idea that troubled American manufacturing industries could use help from their government is gaining acceptance. Although the form such aid should take is not a settled question, the areas of agreement are widening. Agreement embraces more than the traditional areas for government action: macroeconomic policies that create stability and lower the Federal deficit, and human resource policies that produce the well-educated and well-trained workforce that American industry needs. Beyond this, a consensus is forming for more focused government policies to help industry develop and adopt technologies that can boost the competitiveness of U.S. manufacturing. Among these are policies to diffuse technologies throughout manufacturing, as with, for example, government-funded technology extension services.

The area of agreement is expanding to include R&D partnerships between government and industry to develop high-risk technologies of generic commercial interest. Congress created a small program of this sort in 1988, the Advanced Technology Program in the Department of Commerce, and first funded it in 1990. The Program has now gained the backing of the Bush administration. More generally, the President's 1992 Budget endorsed government support for "generic or enabling technologies at the pre-competitive stage of R&D." It said: "The Administration believes that appropriate Federal investments in applied civilian R&D can result in high payoff to the economy. . ."[33]

Helpful as all these policies can be in restoring U.S. competitiveness, in some critical cases they are not enough. Certain industries characterized by expanding markets, good jobs, increasing returns to scale, and technological spillovers to other industries are so essential to the Nation's economic growth that standards of living will suffer without them. Computers and electronic components are the clearest example. Important parts of these U.S. industries are in trouble, and it is doubtful that they can regain their competitive edge without much more substantial technology assistance than that provided by Sematech. Japanese firms are so large, so adept, and so dominant that, without trade technology, manpower, and other policy help from the U.S. Government, the U.S. electronics industry probably will continue to decline in comparison. The help from the STA was on an ad hoc basis that did not signal to the industry any sustained government commitment to the industry, and therefore it did little to encourage investment in technological improvement.

While there may be times when trade policy is a necessary complement to other policies to improve competitiveness, it is emphatically not a stand-alone fix. By itself, trade policy will do little to restore competitiveness and can have deleterious effects on downstream producers and consumers. It is much more likely that policies to encourage technology development and diffusion will be helpful, even without relief from foreign competition, than that trade policy alone will improve competitiveness.

An approach that combines trade policy with technology assistance, and sometimes financial assistance as well, in support of critical commercial industries could be proactive and planned to avoid pitfalls. Any trade protection involved could be framed in a frank and self-respecting way as guarding important American national interests, rather than based on findings of unfair trade by others (as is now the case with most U.S. trade protection). This would skirt three problems that bedevil current U.S. trade policy. First, it is difficult and time-consuming to make charges of unfair trade stick. Second, unfair trade is often only a minor reason for a U.S. industry's decline, secondary to the ability of foreign firms (often aided by industrial policies) to lower production costs, acquire new technologies, and make genuinely superior products at a good price. Finally, whatever the mix of causes, the moralizing tone in our present trade policy is an irritant to our trading partners, and sometimes makes it harder to find reasonable solutions to trade disputes.

The difficulties of creating a coherent government strategy for supporting critical commercial industries should not be underrated. There is merit in the argument that our form of government is open to capture by special interests, so that the chances of getting rational, disinterested government decisions on industry support are slim. Experience suggests, however, that a contrary argument also has merit. The United States does employ some trade protection and does sometimes subsidize certain economic sectors (e.g., farm price supports). These departures from our free trade and free market philosophy are often politically motivated. It is possible that a coherent strategy to select a few industries for their contribution to the national good and support them with a tailored mix of technology, financial, and trade assistance would result in more rational exceptions to a general rule of free trade.

A related problem is that the U.S. Government does not have the experience or institutional capacity to operate a strategic industry and trade policy. Ideally, we would need an institution capable of identifying critical industries, analyzing their needs, and planning measures to fit the needs while taking care to keep the government support modest, make industry a full partner, and foster competition among firms within the critical industries. A tall order, and one that could only be filled over time. The rule would be to start small, gradually building expertise and a spirit of mutual trust with industry.

Another condition for a strategy in support of critical commercial industries is commitment from both Congress and the Administration, backed by wholehearted support from the American people. Congress has taken the lead in recent years toward giving some support to critical industries (e.g., in creating and funding Sematech and the Advanced Technology Program). The Administration also now supports a government role in developing generic technologies of commercial interest. It is hard to imagine, however, that Congress could unilaterally create broader industry and trade policies in support of critical industries and the institutions to carry them out. For the policies to work, both branches of government must be committed to them, and that commitment must rest on the understanding and support of the American people. There would have to be widespread comprehension that U.S. economic security is at risk, agreement that government-industry partnerships for improved competitiveness can pay off, and acceptance that short-term costs are worth paying in return for long-term gains in restoring excellence to U.S. manufacturing.

While the obstacles to crafting an effective strategy to support competitiveness are great, so are the payoffs. Improved competitiveness can come only from improvements in productivity and technology; these, in turn, can support higher standards of living for most Americans. This not only gives individuals more choices and comfort in their own lives, it also increases U.S. resources to do things that only rich nations are equipped to do: fight poverty and illness here and abroad, protect environmental amenities, expand the frontiers of science.

The policy issues and options discussed below include:

- building new institutions to plan and implement a government strategy in support of critical commercial industries,
- fostering a supportive environment for technology development and adoption,
- altering trade policies so they are more effective and more attuned to competitiveness needs, and
- forming government-industry partnerships for technology development and low-cost production.

Institutions for a Strategic Competitiveness Policy

Actions and Policy Tools

A necessary first task for a government agency or commission given responsibility for industry and trade strategies is to identify the critical commercial industries that will be the focus of policy attention. This selection does not mean that other industry will be ignored; an economic and policy environment that supports industrial advance across the board is also necessary. But the concept of a critical industries policy is that some industries contribute more to continued technological advances and rising prosperity than others.

Most advanced countries do lend policy support to certain industries, and the criteria for selection are generally the same; they favor industries that are knowledge intensive (with a high proportion of technical workers and high R&D), that have good prospects for growing markets, and that are built on versatile core technologies with spillovers to other industries. Another principle arguing for government involvement is high barriers to entry arising from exceptional capital costs, large economies of scale, and a steep learning curve, so that late entrants are at a great disadvantage. These principles usually lead to selection of much the same industries, including electronic components, computers and software, communication equipment, precision machining equipment, advanced materials, robotics, biotechnology, and aerospace.

Governmental and private bodies in several countries have made lists of emerging technologies, around which new critical industries (or advanced versions of existing industries) might coalesce. These lists too have many similarities—including the assessment that the United States will lag behind its major competitors, especially Japan, if current trends continue.[34]

The specific policy tools available to the agency cover trade, technology, and financial areas, and are discussed below. Its overall responsibility would be coherence and coordination. It could be given the duty not only to develop critical industry strategies but also to champion them throughout government, reminding and urging other agencies to give critical industries priority in their decisionmaking. Congress might wish to emphasize this function by requiring Federal agencies to prepare a "competitiveness impact evaluation" before taking major actions affecting critical industries. The extra paperwork involved could be well worth its cost if it served as a constant reminder of the potential impact of government policies on industrial competitiveness.

Finally, interaction with industry is a must. A government agency with strategic trade and industry responsibilities should have some independent knowledge and goals, but it must also work in alliance with industry—which would be expected not only to help shape the strategic plans, but also to put up at least half the funds in any venture where the government provides financial backing.

Alternative Institutions

Institutions that might develop and implement government policies to support critical commercial industries could take several forms. A certain amount of restructuring and reorganizing of current Federal functions would help. But it takes a lead agency to plan and carry out a coherent strategy in which high reward industries are selected for particular attention and in which elements of technology, trade, and financial policies are combined as needed.

Industry-specific advisory committees, established by Congress, might be one way to begin. There is a precedent for this. In the 1988 trade act, Congress created the National Advisory Committee on Semiconductors (NACS), made up of industry and Federal Government leaders, to devise a strategy for strengthening the U.S. semiconductor industry. The Committee has issued two interim reports and will publish a final one by the end of 1991, laying out a comprehensive strategy. This is just a first step, however. No agency has responsibility for coordinating and carrying out the NACS-recommended strategy, and there is certainly no guarantee that it will do more than gather dust.

An existing agency with the potential for combining strategy development with action is the Competitiveness Policy Council, created by Congress in 1988 and launched in 1991.[35] With members appointed both by the President and by leaders from both parties and both Houses of Congress, the Council is structured to take a bipartisan approach that could be effective. However, it would need broader powers and a longer life than it has now. Its present duties are only to develop recommendations for greater competitiveness, and unless continued by

Congress, it will go out of existence in 1992. It might be turned into a commission, given at least a 5-year life, and directed explicitly to identify critical commercial industries and strategies to support them. It would also have to be given some power to implement the strategies if it is to have a real impact.

Another possibility is to lodge the responsibility for industrial strategies and trade policy in a small office in the executive branch, possibly in the Executive Office of the President. That location would be a good position from which to remind and encourage other agencies to consider effects on competitiveness in all their major decisions. This could only work, however, if the office is seen as truly competent and well-informed, with close interaction with industry and a staff of exceptional people. And it could have little effect on other government agencies unless it had strong Presidential backing. Major government reorganization is not required, but it could help. If Congress wishes to adopt a more proactive approach to trade and competitiveness issues, a reorganization could produce more focused policymaking and more direct lines of authority. In trade matters, for example, the U.S. Trade Representative (USTR) is charged with coordinating all relevant government agencies to formulate trade policy, and then with negotiating from that position. However, the USTR's own staff is thin and lacks continuity; it can do little more than concentrate on current issues. Yet responsibility for a durable, strategic approach to trade policies that guard basic American interests is lodged there. Much the same is true of policies that influence industrial competitiveness. The absence of a strong voice in government for international competitiveness just about guarantees that other objectives (e.g., foreign policy, national security) will win in a dispute.

Several bills in Congress have proposed a reorganization to focus Federal trade and competitiveness policy functions. Some would establish a Department of International Trade and Industry, assuming many of the functions of the Department of Commerce and the USTR.[36] Some concentrate on trade; they would set up a department that consolidates USTR and the trade policy units from several departments and would establish a Cabinet committee to coordinate international economic policy. Others focus on technology and industry. There have been several bills to create a Department of Industry and Technology, expanding the Commerce Department's export promotion authority and creating a Civilian Technology Agency (CTA);[37] some of these bills would also create an independent U.S. Trade Administration, consolidating the USTR and the Commerce Department's trade agencies.

Whatever bureaucratic arrangement is chosen matters less than the substance of the strategic policies and the commitment of both the Administration and Congress. No arrangement will solve all coordination problems; there are always competing government objectives related to trade and industrial competitiveness. And no arrangement will create a U.S. equivalent of Japan's powerhouse Ministry of International Trade and Industry. What it could do is make possible a modest start in pulling together policy strands that would promote critical industries and our national economic welfare.

A Technology-Friendly Environment

Some of the most important options to help critical commercial industries perform better could also improve the competitiveness of all American industry, across the board. These are options to create a hospitable environment for the development and adoption of new technologies generally, throughout manufacturing, and they merit close consideration whether or not more targeted efforts are undertaken to nurture particular industries. OTA's earlier report, *Making Things Better: Competing in Manufacturing*, considered in detail options to help manufacturers improve their performance through better use of technology. Defined broadly, technology includes not only new products and advanced production machinery, but also efficient organization of work and effective use of people.

Industry and government both have parts to play in building a better technology base for U.S. manufacturing. The report defined four areas in which government could usefully contribute:

- **Improving the financial environment** for U.S. firms, which means taking action to reduce capital costs and relieve other pressures to show high profits every quarter.
- **Upgrading the education and training** of the managers, engineers, technicians, and workers needed in manufacturing.
- **Diffusing technologies** throughout the manufacturing sector.
- **Forming a strategic technology policy** to promote the development of new technologies

with commercial promise through collaborative ventures with industry.

Options in the first three categories outlined above would benefit all U.S. manufacturing with no distinctions among industries. The fourth is for a more targeted effort, and is discussed in a later section. Most of the options summarized in this section are analyzed in greater detail in two recent OTA reports, *Making Things Better* and *Worker Training*, as well as in chapter 2 of the full report.

The Financial Environment

The U.S. financial environment is not hospitable to long-term investment in new technologies and production equipment. High capital costs favor taking short-term profits rather than investing for the longer run, as do pressures from the stock market. Capital costs are affected by several factors, including interest rates, the economic depreciation of investment and its tax treatment, and other fiscal incentives for investment. Recent studies that take all these factors into account provide solid evidence that U.S. capital costs have been substantially higher than those of Japan and Germany for more than a decade, through 1988.[38] Moreover, the terms on which capital is made available are more favorable to long-term investment in both Japan and Germany. An example is the stable shareholding system in Japan, in which the majority of shares in large corporations are held by either companies in the same group or by stable shareholders, and these companies do not trade their shares.

In the United States, government policy has contributed damagingly to high capital costs. The main culprit at present is the huge, accumulating Federal budget deficit, which puts upward pressure on interest rates. Also, the U.S. tax system has many fewer incentives for productivity-enhancing investment in manufacturing than those of our competitors, especially Japan. The dilemma is that some specific fiscal measures that might help firms modernize and invest in new technologies would also tend to worsen the budget deficit, because they would lower revenues, at least in the short run. The budget agreement of 1990 forbids this unless there is a compensating rise in tax revenues or decline in spending elsewhere in the same segment of the budget (nondefense domestic programs). If Congress wishes to lower capital costs through tax breaks, it will need to find something else to cut, or get agreement to raise taxes in compensation. Ultimately, economic growth based on better competitive performance could ease budget problems, but in the short run there will be a price to pay.

Another choice is to increase savings, and thus ease pressure on interest rates. Options include a national savings campaign, with appeals to patriotism plus attractive interest rates for regular payroll savers, or perhaps a consumption tax designed to escape the severe regressive effects of a flat tax. Another option is further restrictions on deductions for home mortgages.

Tax breaks to industry, such as accelerated depreciation for investment in new equipment or a tax credit for R&D, have shown positive effects in the past, though the exact size is debatable. Also, they are expensive—especially accelerated depreciation, which can cost the U.S. Treasury tens of billions per year; whatever they cost would have to be made up elsewhere.

Incentives to hold investments longer might relieve some of the pressure to focus on short-term profits. One option would be a capital gains tax that favors long-term gains and penalizes short-term turnover. It would be most effective if applied to pensions and other funds that are now tax-free, since these funds hold one-third of all stocks and probably account for half of transactions on the stock market.

Human Resources

Success in manufacturing depends on having well-trained people, comfortable with the demands of advanced technology, at every level from the manager's office to the shop floor. The failures of our public schools in turning out well-educated young people with good work habits is well-known. Unfortunately, training of adult workers in the United States is deficient compared with that in several other countries, in particular Japan and Germany.

The quickest payoff may be in improved training of the active workforce, since improvements in schooling take many years to show up on the job. An aggressive, far-reaching option, which guarantees more training without any direct cost to the government, is a payroll-based training levy. Employers would have a choice of spending a certain amount on training their workers or paying the same amount into a national training fund. Several foreign countries, including France, Germany, Ireland, and the Republic of Korea, use the system. Government

might also offer technical assistance on training needs and best practice training methods to trade associations, labor-management groups, or industrial consortia. Restoration and improvement of formal apprenticeships is another option for government-industry partnership. And the Federal vocational education program has many useful features, including school-to-work programs, but they lack adequate funding.

Training linked with technology assistance is effective, and a few States provide it. However, technology extension services are scarce and spotty in the United States, and the link with training is scarcer still. The National Institute of Standards and Technology (NIST) is in charge of the Federal Government's modest technology extension effort; it could add a training component. The Federal Government could also take a more active hand in testing and evaluating computer-aided training technologies, including adapting and transferring instructional technologies developed for the armed forces.

Because education and training of engineers is a central competitiveness issue, the Federal Government could also be more active in this regard. While the supply of engineers seems adequate now, it could dry up in future years as the proportion of white males in the work force declines; white males predominate in engineering. This is essentially a problem to be solved in public school education; attitudes to math and science are formed early. Meanwhile Federal grants to women and minorities to encourage science and engineering careers seem to get results, and deserve support. Retraining of midcareer engineers is another way to enlarge the supply over the next few years, especially at a time when engineers are losing jobs in defense industries.

Technology Diffusion

U.S. institutions for diffusing new technologies throughout manufacturing are thin. Even large firms with the resources to develop or acquire the technologies they need often neglect to take what they could from outside the firm. Many of our 350,000 small and medium-sized manufacturing firms are worse off, with only scant exposure to new technologies.

Technology extension services funded by government could improve the manufacturing of small and medium-sized firms, but so far it is more potential than actuality. Defining industrial extension as one-on-one technical advice given to individual firms, 16 States had such programs in early 1991, and another 7 had technology demonstration or assistance centers. Spending by the 23 States for 27 centers amounted to about $50 million. A small Federal program was established under NIST administration in 1988; it now includes five centers, with one more planned, each with Federal funding of about $1.5 million per year and an equal amount from State, local, and private sources. For perspective, compare these scattered programs with technology extension in Japan. Besides the nationwide system of 185 technology extension centers, funded at about $500 million, half from the national government and half from the prefectures, many Japanese cities, wards, and other localities support industrial halls that offer similar services. These include regular workshops on common manufacturing problems, use of specialized equipment at low fees, demonstrations of new technologies, plant visits by field agents, and referral to expert consultants for advice on special problems.

If Congress wished to support a wider network of technology extension centers, it might set a minimum goal of 120 centers, serving about 24,000 small and medium-sized firms per year and costing about $120 to $480 million a year, depending on the level and quality of service. Some of the funds could come from State or private sources, though it may be unrealistic to demand that these sources take over all the funding within a few years (as the law provides in the case of the NIST centers). A program of this size might soon prove insufficient. It would serve about the same percentage of small and medium-sized manufacturers (7 percent) as is served by Georgia Tech's well-regarded industrial extension service for firms in the State of Georgia. That service does not advertise for fear of being swamped with requests.

Another promising option with at least two major advantages is a system that would allow manufacturers to lease modern production equipment, or buy it on the installment plan, at subsidized rates. The system would encourage firms to use up-to-date equipment, such as computer numerically controlled (CNC) machine tools. If the system bought U.S.-made equipment, it would also benefit U.S. builders of the machinery by offering a stable assured market for part of their output. An equipment leasing system for CNC machine tools, for example, could start with modest government funding—probably about $3

million per year.[39] It could be open only to small firms, or open to all with lower rates for small firms. An option with somewhat similar effects is special tax incentives for investments in advanced manufacturing. This is one of the many inducements to modernize that the Japanese Government offers to businesses, especially small ones.

Commercialization of technology from Federal laboratories is a goal that Congress has actively pursued for more than a decade through laws and oversight. There has been progress, but the goal is far from fully realized. On the industry side, many firms fail to pursue energetically what they could get from the Federal labs. On the government side, the two main obstacles are too little money and too much red tape. With other missions taking priority, lab funding of technology transfer has been scanty. Bureaucratic hoops in the parent agency, especially delays for legal review, have many times stalled technology licensing and the conclusion of cooperative agreements between the labs and private industry.

Since Congress passed its latest (1989) law promoting technology transfer, approval of industry-government cost-shared cooperative R&D agreements has speeded up (it now often takes less than the 90 days allowed under the new law), and such projects are becoming more accepted. The Department of Energy (DOE) has moved to grant some of its big multiprogram National Laboratories the freedom to conclude most such agreements with industry with only a limited wait for agency review. A high level DOE group, the Technology Transfer Project, is working on easing licensing as well as cooperative R&D agreements. Problems remain, however. An umbrella agreement for an Advanced Manufacturing Initiative, negotiated between the National Center for Manufacturing Sciences (representing over 100 companies) and DOE (covering several of the national labs) was not formally launched until July 1991, nearly a year after its announcement. Moreover, funding to promote commercialization is still limited.

Congress might wish to earmark some of the labs' R&D appropriation for commercialization efforts, perhaps mandating that a few percent of the budget be set aside for the purpose. Also, continued congressional oversight seems to be necessary for getting over bureaucratic roadblocks.

Improved protection of intellectual property and modest changes in antitrust law might bolster the competitive position of some U.S. manufacturing industries. Better patent protection could start at home with speedier enforcement—patent cases that go to trial usually take 2½ years. Congress might consider designating special patent judges with the technical knowledge to move cases through faster (similar in principle to the tax courts). In foreign markets, the Japanese system has been a special problem. It is slower than the U.S. system in issuing and enforcing patents, and it strongly favors licensing of patents, which U.S. companies often do not wish to do. While the U.S. Government negotiates with Japan on these problems, Congress might establish a program in the Patent Office to provide U.S. firms with information on the Japanese system.

Antitrust law and enforcement have been greatly relaxed in the past decade. Changes have been made to allow cooperative endeavors that could improve U.S. competitiveness; perhaps some further moves in that direction could be considered. For example, Congress might allow the Justice Department to certify in advance that joint projects do not violate the law, or to establish "safe harbor" market shares, so that shares below a certain percentage would not be in violation. Probably most important, Congress could recognize that joint ventures or mergers between U.S. firms are sometimes necessary to fend off foreign competition, and could instruct the courts to listen seriously to such arguments. Congress might also instruct the Justice Department and the courts to weigh carefully the long-term competitive effects of a foreign firm's taking over a U.S. firm.

Finally, information and exhortation to American manufacturers on how to make things better, given under U.S. Government auspices, have proven surprisingly effective. In 3 years, starting in 1988, the Commerce Department has given the Malcolm Baldridge National Quality Award to nine companies meeting the award's high standards. In that time, 203 companies applied for a possible 18 awards (2 each in 3 categories for each year). The award costs the taxpayers next to nothing. But it has become an excellent means of technology diffusion in several ways. Just filling out the application is instructive. Then, all applicants, win or lose, receive reports from examiners outlining their strong and weak points. Finally, the winners are obliged to share the details of what they did to win. Company representatives give hundreds of speeches a year and hold briefing sessions for executives of other companies, including their competitors. One manager who

attended came away amazed at the level of detail—"everything but the financial data."

Trade Policy Options

Promotion of liberal trade (often termed "free trade") has been the policy of the United States since World War II. For two or three decades, this policy served national interests well enough. In the postwar world, the United States was far enough ahead of most other countries that America prospered even when trade was more liberal for imports into the United States than for U.S. exports to some other countries.

Today, with several key U.S. industries fallen to second rank, free trade is not necessarily to the country's advantage, certainly not one-way free trade. Many U.S. industries are struggling to meet foreign competitors equipped with plentiful supplies of patient capital and cutting-edge technology. The outlook is particularly bleak for small or startup firms trying to break into markets dominated by powerful multinationals. Today, most of the high-reward industries—characterized by high knowledge intensity, particularly large economies of scale, positive spillovers to other industries, and well-paid jobs—are tough to survive in without government help. Indeed, except for the United States, most developed nations have some kind of government program to promote the competitiveness of high-technology industries.

Why has the United States been so vulnerable to these foreign programs? Industry is partly to blame. Many U.S. managers have stuck far too long with outmoded technologies and management styles. But government is also to blame. Unlike its ablest competitors, the U.S. Government has not pursued domestic programs to develop its own important industries. The only way that the U.S. Government has responded to tough foreign competition is as a trade issue: it has attempted to open foreign markets, and it has at times levied extra import duties intended to compensate precisely for foreign subsidies and dumping. However, important foreign market barriers have often taken many years to remove. Similarly, U.S. law regarding subsidies and dumping has done at best a slow, incomplete job of compensating for advantages that foreign industrial policies confer, and the extra duties levied at the border are inherently inadequate to compensate for another country's domestic policies.

Rather than reacting to foreign governments' initiatives, always at least one step behind, it would be easier and more effective to improve U.S. competitiveness using domestic programs. Measures might include R&D incentives, tax breaks to encourage R&D and capital investment, increased commitment to technology diffusion, and support for education and training. Trade measures—trying to open foreign markets, and protecting the U.S. market—could be used when necessary, but in a subordinate role. Moreover, these trade measures could be used more strategically. Efforts to open markets could focus on areas of the greatest strategic importance; and protection could be based not on legalistic criteria, but on the industry's need and place in the economy.

Some say that government cannot and should not pick industries to promote, and that attempted government assistance to particular industries is likely to make them less rather than more competitive. However, there is general agreement on many of the technologies (e.g., electronic components and information technologies) that are key drivers of industrial performance, and it is not hard to identify industries that use those technologies. And while government intervention has sometimes been counterproductive, the experience of several governments provides guideposts for what approaches work best. For example, industry should take the lead in proposing joint government-industry R&D programs and should shoulder much of the cost; policies should conform with market forces as much as possible; U.S. industry must compete with the best in the world; and industry must work to improve its competitiveness and outgrow the need for assistance.

Responses to Foreign Market Barriers

Foreign market barriers often hurt U.S. industries. While GATT has reduced quotas (quantitative restrictions on imports) and tariffs (taxes on imports, also called duties), there are many other barriers to imports. These include burdensome customs procedures; discrimination in standards, regulations, and government procurement; and private agreements, tolerated or encouraged by the government, that tend to exclude foreign products.

Normally, the U.S. response, if any, is to negotiate to eliminate barriers, with negotiations led by the Office of the United States Trade Representative (USTR). The United States is hindered by lean

USTR staffing, frequent turnover of senior government officials, and the representation of foreign interests by former key government officials. To address these problems, Congress might wish to increase USTR staffing, create more high-level career positions at the USTR and other government agencies, and prohibit senior trade officials from representing foreign interests for several years after they leave government service.

Other reasons why foreign markets can take many years to open are harder to address. Barriers take time to identify; other countries can stall negotiations; countries hedge on promises to remove barriers; and when one barrier is removed, another can take its place. And some barriers are ingrained in a country's business practices and domestic policy, making their removal difficult even if the foreign government is willing.

The United States has only limited leverage to induce foreign countries to remove barriers. GATT dispute resolution procedures, while recently improved, are still slow and uncertain. Continuing U.S. efforts in the Uruguay Round to improve these procedures might be productive. Congress might also wish to consider the ambitious task of creating a new multilateral trading system, with a much stronger commitment to and enforcement of free trade. Such a system would require a great deal of planning and commitment, and probably would have to be limited to a very small group of like-minded nations in the beginning.

The United States can also threaten to retaliate with barriers of its own to imports from the country in question. Under Section 301 and related sections of the Trade Act of 1974, as amended,[40] the USTR can investigate foreign trade barriers, negotiate for their removal, and if necessary retaliate. However, even the investigation phase angers trading partners; and retaliation would most often violate GATT, could provoke counter-retaliation or GATT challenges, would not solve the problems of the U.S. industry facing the market barriers, and could cause problems for downstream U.S. industries. Therefore, Section 301 is not a very serviceable tool.

Limited U.S. leverage makes negotiations often slow and ineffective. Barriers that cause particular damage—e.g., Japanese barriers to the sale of semiconductors and supercomputers—often persist for years. While market opening is a worthwhile long-term goal, attempts to remove specific barriers often provide little or no relief in the interim, during which time the affected U.S. industry can suffer serious and irreversible damage.

U.S. policy toward market barriers could be reoriented to emphasize domestic measures to maintain competitiveness rather than negotiations to remove barriers. Normally domestic measures, such as R&D support and tax breaks, could keep an industry competitive even in the face of trade barriers. While opening foreign markets could still be pursued as a long term goal, there would be no urgency requiring measures that would anger trading partners. It would also make sense to allocate the government's limited negotiating resources according to an industry's strategic importance.

In exceptional cases, domestic measures might not be enough. This might be the case with semiconductors; limited access to Japan's market, the largest and most discriminating in the world, can be an important handicap to U.S. firms. In the rare case of an important U.S. industry facing substantial harm from foreign market barriers that domestic measures cannot alleviate, the national interest might be served by pulling out all the stops to remove the barrier: quick, aggressive negotiations led by high-ranking officials, perhaps with cabinet-level or even Presidential involvement, followed if necessary by the threat of substantial retaliation, carried out if necessary.

Use of Protection

U.S. industries normally receive protection against imports only when they are dumped or subsidized. In this case, an extra duty can be assessed in an amount that in theory precisely counteracts the trade-distorting subsidy or dumping. However, U.S. law and practice regarding subsidies and dumping by and large fails to compensate for the advantages foreign governments create for their firms. The reasons include delay, difficulty in proving subsidies or dumping, the law's ignoring or devaluing certain subsidies, difficulty in proving the required injury, and the high expense of legal proceedings. A further problem is that the effects of government assistance can increase over time, rather than dissipating as the law assumes. To some extent, the law's limited effectiveness stems from adherence to GATT requirements.

A more effective approach would be to assist industries beleaguered by imports primarily by

domestic measures to promote competitiveness through cost control, productivity enhancement, and quality improvement. Where domestic measures alone might not suffice, protection could also be used, lasting only as long as strictly necessary. Criteria for awarding protection would include the industry's need, its merit (including whether the industry was making reasonable efforts on its own and showed promise of effectively competing on its own), and the importance of the industry in the U.S. economy.

Protection roughly along these lines already exists under Section 201 and the following sections of the Trade Act of 1974, as amended, which is patterned after GATT's so-called "escape clause" (GATT Article XIX). Section 201 permits the President to grant import relief for up to 8 years when the International Trade Commission (ITC) finds that increased imports "cause or threaten serious injury" to an existing U.S. industry.[41] However, Section 201 has rarely been used in recent years, and as currently written and interpreted is not very serviceable. The injury requirement usually will not be met before serious damage is done, and meeting it is especially hard for high technology industries with rapidly growing markets. While Section 201 could be amended to cover these situations, there is some question as to whether that would be consistent with GATT.

Congress could empower the President to grant protection apart from Section 201. Under GATT Article XXVIII, the United States could negotiate with other countries to accept higher U.S. tariffs on certain goods in exchange for reduced U.S. tariffs on other goods. While reduced tariffs on the other goods could adversely affect other U.S. industries, the government could possibly mitigate such effects with tax breaks or other programs. Also, continued protection ideally would depend on sufficient effort from industry to improve its competitiveness. If other countries would not agree on compensation, in rare cases as a last resort the United States might impose protection anyway and risk a GATT challenge. To some other nations, that might be interpreted as a signal that the United States was abandoning its commitment to GATT and free trade. While this is a risk, it might be preferable to the alternative of losing critical industries altogether.

Promoting Exports

Nearly all industrialized nations promote exports. Exporting is difficult, requiring firms to overcome differences of language, geography, and custom. Governments help firms to learn about markets, to identify potential customers and distributors, and to comply with administrative requirements. Such assistance seems particularly needed in the United States, whose firms must export more manufactured goods than before. However, the United States spends far less promoting manufactured exports than many of its important trading partners. In the late 1980s, low funding even led to situations such as commercial officers in U.S. embassies not having funds to return phone calls from U.S. firms. While budgets have improved somewhat in the last few years, Congress might wish to consider funding more on a par with that of other countries. Congress might wish to make a policy statement that export promotion should be a priority not only for commercial officers abroad but for the whole diplomatic staff. Cabinet-level involvement in promotion activities, such as Commerce Secretary Mossbacher's presence in Tokyo in April 1991 to kickoff the Japan Corporate Program, could also be encouraged.

Nearly all industrialized nations also assist firms with export financing. In the United States, applications for financing assistance for manufactured exports must be justified on a case-by-case basis; the need for justification increases delay and the burden on the exporter. Congress might consider adopting the approach used by Japan and many European countries, which determine in broad policy terms what exports to assist and then assist all creditworthy exports within the guidelines. Many other countries condition some of their foreign aid on purchases of capital goods, construction services, and the like from the donor country. While the United States also ties some aid to purchases, U.S. nondefense aid focuses on agriculture, nutrition, health, and education, rather than large capital projects. U.S. effort to improve international agreements limiting the use of tied aid is worth continuing. However, it is uncertain how successful that effort will be. Congress could expand the so-called War Chest for matching foreign tied aid offers to more effectively discourage foreign tied aid. The War Chest was funded at $150 million in grants for fiscal year 1991, though as of July 1991 only $58 million had been used. Some other countries spend many hundred million dollars annually.

Congress could expand the Trade and Development Program (TDP), funded at $35 million for fiscal year 1991. TDP helps to pay for feasibility studies or other planning assistance performed by U.S. firms for capital projects in developing and middle-income countries. U.S. participation in the planning phase has often helped U.S. firms win contracts for the actual project. So far, $161 million in program funds have led to documented U.S. sales totaling $3.2 billion, with an estimated $18 billion more sales expected as projects mature.[42] In expanding TDP or otherwise increasing the emphasis on capital projects, care should be taken to avoid adverse environmental and social effects, which in the 1970s turned the United States away from such projects.

As well as promoting exports, the U.S. Government at times impedes export of high-technology goods and data by its system of export controls. Export of dual-use items—those with both military and civilian use—is regulated by the Export Administration Act of 1979, as amended;[43] this requires firms to obtain a license to export certain items for certain destinations. In 1990, perhaps $90 billion worth of U.S. exports of manufactured goods required a license.

There is a genuine need for some control over exports to guard advanced technologies and products that could be used in weapons against the United States. Yet export controls have also proved an unnecessary hindrance to some manufactured exports, at times merely shifting the business from U.S. to foreign firms. For example, until mid-1990 U.S. export controls limited exports of personal computers based on Intel's 80386 processor, although they were easily available from foreign sources. While U.S. export controls are being reformed, the process is incomplete. Reform could be facilitated, as could ongoing administration of export controls, by a competitiveness policy agency. Such an agency could identify exports with strategic economic importance and help to expedite their approval when possible. While an Administration sympathetic to competitiveness concerns is essential for fully effective reform, Congress could take measures on its own to further decrease unnecessary burden on commercial competitiveness. These measures include better funding and staffing of the office that determines when foreign availability makes U.S. controls ineffective, encouraging more political appointees with technical backgrounds, encouraging more use of automatic indexing to track technological change (subject to yearly review), and court enforcement of congressionally mandated deadlines. Congress could take measures to stop abuse of the State Department's Munitions List, which is supposed to contain only items with purely military use but has been used to control some dual-use items.

An emerging area of concern is the use of so-called "foreign policy" controls, which are largely untouched by the recent reforms. Congress might wish to extend the recent reforms to foreign policy controls where feasible. For example, if the purpose of a foreign policy control is to guard technology for making chemical weapons, Congress could require that items not be controlled without multilateral agreement to control them, and that controls be removed if they are ineffective because of foreign availability.

GOVERNMENT-INDUSTRY PARTNERSHIPS

In addition to trade policy, a comprehensive strategy for greater competitiveness includes promotion of technology development and diffusion, risk-sharing between government and industry, and a generally supportive environment for adoption of new technologies.

Risk Sharing in Technology Development

The least intrusive and least expensive of several risk-sharing options is an R&D partnership for developing new technologies of commercial interest.[44] The main reason for government to support such ventures is that potential benefits to society are great but the likely payoff to individual firms is too small or the possibility of failure too great to make it worth their taking the risk. In the U.S. financial environment, with its high costs and emphasis on short-term profit, government contributions to risky ventures are especially significant.

The Federal Government has in the past given some technology assistance for commercial purposes, but not on a coherent, strategic basis. By far the largest existing Federal program for precommercial technology development is NASA's aeronautical R&D program (amounting to over $900 million per year, including expenses for wages and salaries, R&D, and facility construction), which supports military and commercial technologies. The 5-year

Sematech program, to help the semiconductor industry develop a manufacturing process technologies for memory chips, is large ($100 million per year for 5 years in government funds and a matching sum from industry) and was created ad hoc in response to strong industry pressure and the argument that a competitive U.S. semiconductor industry is essential to national defense.

A small beginning for a more general R&D partnership is the Advanced Technology Program (ATP), operated by NIST in the Department of Commerce. ATP was established in the 1988 trade act, which authorized the Program to assist businesses in doing research in precompetitive, generic technologies. In fiscal year 1990, Congress provided ATP's first funding, $10 million, and raised funding to $36 million in fiscal year 1991.

ATP might in time become a full-fledged civilian technology agency (CTA), although it was not created with that specific mission. Bills to establish more formally an Advanced CTA in a new Department of Industry and Technology, which would replace the Department of Commerce, were introduced in the 100th and 101st Congresses.[45] These bills defined the agency's mission as contributing to U.S. competitiveness by supporting long-term, high-risk projects that are likely to yield important benefits to the Nation but lack adequate private support. A bill that passed the Senate in 1989 would have given the ATP a similar mission, and authorized funding up to $100 million per year.[46]

Any CTA would have to start small, as ATP has, and grow only with experience. A mature agency might have a research budget of $300 to $600 million per year. This very rough estimate is based on the list of about 100 technologies developed by the private-sector Council on Competitiveness,[47] each of which might merit government participatory grants of about $1 to $2 million per year, with enough redundancy that two or three grants might be made in each field.

Collaboration with industry in choosing technologies for support would be essential. If private companies are not interested enough in the technology to put up at least half the money and do much of the work, then the chances for commercial success are probably remote. Joint funding helps the government resist special interests or political pressure in choosing technologies for support. At the same time, a CTA would need a set of guiding principles—e.g., it should look for technologies that are knowledge-intensive and have wide applications in many products and industries.

NASA's experience underscores the importance of collaboration with industry, if the goal is competitive success. Most of NASA's R&D is for military as well as commercial applications, and much is basic research that is quite freely available to the world and has little or no near term application to commercial production. NASA's greatest contributions to competitiveness are in two areas: its facilities, such as wind tunnels and its Numerical Aerodynamic Simulator, which are solely or preferentially available to U.S. companies; and R&D projects in which U.S. companies are close collaborators.

So far, the U.S. Government's offers of collaborative R&D projects have been snapped up by private companies. The Advanced Technology Project's first batch of 1-year cooperative grants, amounting to $9 million, attracted 249 applicants requesting a total of $150 million. Eleven projects, half of them joint ventures or consortia, were chosen; they initiated R&D projects that are expected to cost $100 million (including private funds) over 5 years.

The total dollar amounts in the government's few cooperative R&D programs are tiny compared to the $100 billion per year that U.S. companies spend for R&D. It is remarkable that such small programs have drawn so large a response, including proposals from such industrial giants as Du Pont, AT&T Bell Laboratories, and IBM.

If Congress wishes to continue the expansion of cooperative R&D programs, with the ultimate goal of having an agency of similar size and importance as the Defense Advanced Research Projects Agency (DARPA), it may opt for another modest rise in the ATP budget for fiscal year 1992. It might also consider putting into law a more formal statement of goals for the Program.

Congress has already responded in an innovative way to the question of how to handle participation by foreign-owned firms in cooperative R&D projects. In appropriating funds for the ATP for fiscal year 1991, it set standards that apply to U.S.-owned as well as foreign firms, thus bypassing ownership as the central criterion for participation. The Secretary of Commerce is authorized to decide on a firm's eligibility based on its contributions to high-value-

added manufacturing production and manufacturing employment within the United States. Further conditions apply to foreign firms, based on equal treatment for U.S. firms in the foreign firms' home country. These provisions provide guidance but give the Secretary of Commerce great latitude. Congress may wish to exercise substantial oversight for a time on how these provisions are carried out, and to extend these eligibility criteria for at least a few years to permit evaluation of their merit.

Financial Risk-Sharing

Strategic technology policy goes only so far. It is up to industry to make the much larger investments in product design, manufacturing equipment and tooling, worker training, and acquisition of know-how by managers and production engineers needed for commercial production. It is normal and expected for private industry to make these investments and take the risks. Sometimes, however, in some critical sectors, private investment is inadequate from the standpoint of social benefits. U.S. investment in production equipment is meager compared to Japan's. Japanese investment in machinery and equipment, as a share of GNP, has been twice the U.S. rate since the mid-1970s, and the discrepancy has recently widened. The discrepancy is especially damaging in critical commercial industries, such as semiconductors, that require continuing large investments for new generations of products every 3 years or so.

Government policies to share financial risks with industry can take the explicit form of loans or loan guarantees on advantageous terms, or they can take the form of tax breaks, which are implicit expenditures. Both put burdens on the Federal budget, and Congress cannot opt for either without compensation tax rises or spending cuts. Macroeconomic policies that help to lower capital costs and provide stability are probably the most important help government can provide to encourage greater investment in technology development and deployment by U.S. manufacturing companies. Specific options for financial risk-sharing are worth considering, however.

Of the two forms of risk-sharing, tax breaks are more within U.S. tradition and experience. In the past, U.S. companies have received accelerated depreciation and tax credits for capital investments. Although certain activities (e.g., real estate) have been singled out for special treatment, Congress has not in the past designed tax incentives to improve the competitiveness of particular industries. Across-the-board tax breaks for capital investment would cost the U.S. Treasury tens of billions per year, while loosening the rules for selected industries would cost less. The National Advisory Committee on Semiconductors, for example, estimated that allowing 3-year rather than 5-year depreciation for new investments in semiconductor manufacturing equipment would cost the U.S. Treasury $180 million per year in lost revenues, and would prompt $450 million in added capital investments by the industry.[48]

If Congress wishes to target tax breaks to critical commercial industries, the best way is to make these tax measures part of a comprehensive strategy that includes such things as technology support and trade policy. This presupposes the existence of an institution able to form such a policy.

Direct financial aid to commercial industries is mostly foreign to U.S. experience; the one previous effort, with the Reconstruction Finance Corporation after World War II, was not targeted to critical industries, and is generally considered an expensive failure. If Congress wishes to consider direct aid in exceptional cases, it may wish to start at a very modest scale.

Government Purchases

Government purchases have been an important factor in the birth and growth of several industries, including aircraft engines, semiconductors, and computers; the big buyer in each case was the Department of Defense (DoD). Today, defense purchases are not a very promising source of financial support for critical commercial industries. Technological spillovers from military to commercial products are probably declining (though the evidence on this is mixed). More important, laws and regulations governing DoD purchases are so restrictive and cost-inflating that it is increasingly difficult to combine military and civilian production and to take advantage of whatever spillovers may exist. Post-Cold War declines in defense spending have removed some of the potential support.

Federal, State, and local government spending for nondefense goods amounted to about $97 billion, $10 billion of it Federal, in 1990. Although the total is modest as a share of the GNP for goods (about 5

percent), certain kinds of government purchases can be significant. For example, Federal purchases greatly aided the supercomputer industry's development. This role—being an assured customer for a startup product—is especially significant. Suppose the Postal Service (a quasi-public agency) decided that electric vehicles could help reduce pollution, and that their limited range and need for frequent recharging would not handicap mail runs. A substantial order might give a real boost to a U.S. producer of electric vehicles, providing it with a head start over foreign competitors. Preference for U.S. firms would be consistent with the GATT Procurement Code, which does not yet cover the Postal Service.

Internationally, procurement tells a familiar story: the U.S. market is more open than those of many major trading partners; many major trading partners use procurement as a strategic tool to develop important industries, while the Federal Government generally does not do so intentionally. Congress might wish to reorient U.S. policy to be more proactive: as well as negotiating to make procurement markets more open, the United States could take stock of opportunities to use its own procurement strategically, such as the Postal Service example. There are likely many such opportunities that are not yet prohibited by international agreements. Using procurement strategically would help U.S. competitiveness pending further market-opening agreements and would give the United States more leverage in negotiations. Awareness of strategic opportunities would make the United States a more informed negotiator. For example, if Postal Service procurement of electric cars were deemed a strategic opportunity, the United States might not agree to subject the Postal Service to the GATT Procurement Code unless other countries give up equivalent opportunities.

AMERICAN FIRMS, FOREIGN FIRMS, AND AMERICAN INTERESTS

Government involvement in efforts to boost civilian industrial competitiveness invariably raises the issue of who is eligible to participate. Three decades ago, there were only a handful of true multinationals. Today there are hundreds of firms that have a substantial interest and presence in more than one nation. The stock of direct investment abroad, on the part of firms from all nations, has increased over 10 percent per year since 1960, and by 1988, stood at over $1.1 trillion.[49] Direct investment abroad is increasing much faster than world merchandise trade or world economic output. All developed nations must make decisions about how to treat foreign firms, and increasingly, those decisions center on foreign firms' eligibility to participate in government-sponsored projects to improve industrial competitiveness.

Foreign direct investment in the United States (FDIUS) is also on the increase—in fact, FDIUS is increasing faster than the world average. Between 1967 and 1988, the stock of FDIUS increased from $9.9 to $328.9 billion, or over 18 percent per annum. The world stock of direct investment abroad increased from $105.5 billion to $1.2 trillion over the same period, or 12.4 percent annually. The gross product of foreign affiliates in the United States accounted for 3.4 percent of GNP in 1987, nearly double their 1.8 percent in 1977. The presence of foreign direct investors is especially prominent in manufacturing. In 1987, U.S. manufacturing affiliates of foreign parents accounted for 12.2 percent of the assets of all American manufacturing, compared with 8.9 percent of the total net worth of all nonfinancial corporations. So while foreign companies are relatively small players in the U.S. economy, they control or influence a significant chunk of manufacturing.

The U.S. Government funds relatively fewer industrial-competitiveness programs that could admit foreign firms than governments in other developed nations, especially in Europe and Japan. Nevertheless, we are in the thick of the debate; foreign companies have asked for access to Sematech and the Advanced Technology Program of the Department of Commerce. How we end up dealing with foreign firms or their American affiliates depends greatly on how they behave. American firms too are held up to scrutiny in terms of their contributions to national well-being in the debate, often in caricature; some believe that the typical American firm does little manufacturing or R&D in the United States. When we examine the contributions American firms make to the U.S. economy and living standards and compare it with foreign firms, the caricatures fall apart.

The U.S.-based parent companies of American multinationals act, on the whole, like American companies: their U.S. operations accounted for 78

percent of the companies' total assets, 70 percent of their sales, and 74 percent of their employment in 1988, slightly more on all three counts than in 1977.[50] Contrary to the popular stereotype, there is a slight tendency for U.S. multinationals to do more of their business in the United States than formerly. American multinationals also keep good jobs and develop technology at home: the vast majority of their R&D is done here,[51] compensation per U.S. employee is 39 percent higher than compensation per employee in offshore affiliates, and assets per U.S. employee are 30 percent higher than assets per employee in offshore affiliates.

U.S. affiliates of foreign multinationals behave much like American firms in America, although there are some key differences. Affiliates do not differ significantly from American companies in terms of compensation per employee and investment in plant and equipment as a percent of sales.[52] They treat their employees similarly during economic downturns, being about as likely to lay off workers as American companies. U.S. affiliates of foreign multinationals are, on the other hand, less likely to do R&D in the United States than American companies; the R&D intensity (spending on R&D as a percent of sales) of U.S. manufacturing affiliates was about half that of American manufacturers. This is consistent with common behavior by multinationals (including American multinationals), most of whom do the bulk of their R&D at home. Aggregate data on the hours and quality of training given in U.S. affiliate companies are not available. We do know that workers and managers in Japanese motor vehicle transplants receive substantially more training than workers and managers in American companies' auto plants. Overall, however, we would expect to find little overall difference in the amount or quality of training given to workers in U.S. affiliate companies, compared with workers in American companies.

There are two sources of real difference between the behavior of affiliates and the behavior of American firms. Foreign affiliates are *far* more likely to import than American-owned companies, and affiliates of Japanese parents more so than affiliates of European or Canadian parents. The merchandise trade deficit associated with affiliates of foreign parents is substantial; in 1988, it was $90 billion, three-fourths as large as the entire U.S. merchandise trade deficit.[53] It is a mistake, however, to hold foreign companies primarily responsible for America's poor trade performance. In large part, we are responsible for that: our anemic savings rate does not generate enough capital to cover our investments; our appetite for consumption is greater than our production; foreign goods are often better and/or cheaper than domestically made ones. The fast increases in foreign direct investment, and the associated trade deficit, are mainly results of these underlying weaknesses, not the causes. In other words, if we somehow prohibited American affiliates from importing, or forced them to export more (like some developing countries do), and changed nothing else, we would expect the dollar to fall in compensation.

Japanese direct investors also behave very differently in many respects than other foreign investors or American firms. Their propensity to import is higher; in 1988, affiliates of Japanese companies' imports totaled $75.9 billion, 51 percent of total imports of affiliates. Japanese affiliates' share of U.S. sales was only 26 percent of the sales of all affiliates. Moreover, Japanese affiliates imported almost exclusively from Japan; 93 percent of their imports came from Japan. Other foreign affiliates import from home, but to a much smaller extent; European affiliates got 70 percent of their imports from Europe (although the attachment of affiliates of any nation to imports from that particular nation is less strong) and 73 percent of Canadian affiliates' imports were from Canada.

Japanese direct investment appears to be far more oriented to selling Japanese products abroad than the investment of European nations or Canada. This shows up not just in the propensity of Japanese affiliate companies to import from Japan, but in the profile of investment; Japanese firms are more likely than European firms to invest in wholesaling affiliates, particularly in motor vehicles, and their primary activity is to sell Japanese products. Possibly as a result, Japanese parents are more likely to maintain tight control over their affiliates than are European parents. American affiliates of Japanese electronics companies mostly employ Japanese managers, while American electronics affiliates in Japan mostly employ Japanese managers. This pattern of affiliates of Japanese companies having Japanese CEOs holds true in other countries as well as in the United States.

Is there a reason to be especially concerned about—or even wary of—Japanese investment?

There are concerns that Japanese investment in high-tech firms may simply be a vehicle for fast transfer of technology to Japan, and possibly the eventual benefits (manufacturing, employment, value added) that flow from innovation. But Japanese direct investment has had many positive effects as well. Japanese direct investment in automobile manufacture has raised the standards of quality among American auto parts manufacturers that have sold to Japanese transplants. The transplants have also been largely responsible for demonstrating how efficient, high quality Japanese auto assembly works and, to some extent, transferring knowledge of how to manage such enterprises. Japanese transplants in autos have admirable records of training employees and managers. Given our inclination to consume and unwillingness to save, increased foreign investment was inevitable. It is little wonder that it should come from Japan, whose companies are richer and more competitive than any others. As to differences in Japanese affiliates' behavior and investment patterns, it is possible (though by no means universally accepted) that these stem more from the inexperience of Japanese firms in investing abroad and managing affiliates than from peculiarities of Japanese business practice, and that in time their behavior will come to resemble that of other multinationals. On the other hand, it is also possible that there are certain kinds of Japanese investment or business practice that will not contribute to American well-being. Careful monitoring over the next few years will be needed in order to determine how to treat Japanese affiliates.

In the meantime, we are still faced with the choice of including or excluding U.S. affiliates from government programs like the Advanced Technology Program. Private research consortia also receive inquiries from foreign firms and their U.S. affiliates. While such private organizations often restrict membership based on a firm's nationality, government programs (except those whose mission is national defense) often cannot. Nominally, all nations that belong to the Organization for Economic Cooperation and Development (OECD) subscribe to the principle of national treatment, which stipulates that foreign firms should be treated exactly the same as domestic firms.[54] In practice, most nations of the OECD base decisions on participation in government-sponsored competitiveness programs on other criteria. One is mirror reciprocity, meaning that affiliates of foreign firms are given the same treatment in the host country that the host country's firms are given in the foreign affiliates' countries. Another is performance standards. In Europe and the United States, affiliates or subsidiaries of foreign parents must meet certain standards, for example, establishing manufacturing and R&D facilities in the country, or adding a certain percentage of value domestically, to be considered for participation. As of mid-1991, both reciprocity and performance standards govern participation in the Department of Commerce's Advanced Technology Program. The EC uses similar criteria, with respect to American firms at least, to govern participation in the Framework Program. (See ch. 5 of the full report for further discussion of the EC's Framework Program.)

The issue of how affiliates of foreign firms are treated in the United States is assuming greater importance as a competitiveness question, but at the moment it is of less concern than what we do to improve the competitiveness of American firms. There is increasing agreement (far from unanimous) among analysts that there are many things the government could do to assist U.S. firms to become more competitive, including many of the options noted above, in the summary of policy options.

U.S. TRADE POLICY

Since World War II, the United States' overriding objective in trade policy has been to promote free trade throughout the world, using the GATT system and, to a lesser extent, bilateral negotiations. The GATT system has reduced quantitative barriers to trade (quotas and tariffs), and as a result is often given credit for the increase in world trade.

For most of the postwar period, U.S. firms prospered under this regime. To be sure, some industries had problems, even in the 1960s when most U.S. industry was at the technological forefront of global competition. The textile and apparel industries, for instance, relied heavily on unskilled and semiskilled labor, and as a result faced competitive pressure from low-wage countries quite early; treaties limiting textile imports were signed in the 1950s. Television manufacturers came under pressure from imports in the 1960s, as a result of both high production costs and, toward the end of the decade, superior technologies (solid state circuitry) in Japanese products. Until the early 1980s, the industries that had competitive trouble were regarded as outliers, which the United States could

probably afford to lose as it shifted into high-technology sectors. But in the 1980s these trade troubles spread. The indisputable fact emerged that American technology development and diffusion was deficient in even the most high-technology industries.

Now, it is difficult to find an American industry that is in no competitive trouble at all, and there are a few where only fast and drastic action can preserve domestic manufacturing. Moreover, American firms are significantly behind in an increasing number of emerging technologies and industries. Trade increasingly exposes U.S. companies to competition from foreigners with superior technologies, deeper pockets, better trained workers, and governments determined to provide their indigenous firms with advantages.

Some of these advantages are nationwide—e.g., first-rate education, encouragement of household savings, and tax breaks for R&D and capital investment. Some governments, notably in Japan, Korea, and Taiwan, have also targeted for support specific industries, such as semiconductors and computers, that seem to contribute disproportionately to a nation's wealth and economic development. Developing such industries is often a race in which the firms or nations that get ahead will likely stay ahead for some time. A company with technical advantages or greater market share can reap economies of scale or learning, which will let it capture additional market share or finance more R&D than its competitors, enabling it to pull still further ahead.

Governments have targeted critical industries with both domestic policies and home market protection. Domestic policies include R&D support, special tax breaks, preferential financing, and tolerance or encouragement of cartel pricing in specific industries. R&D programs can give firms a technical advantage over competitors abroad or at home. Special tax breaks or other financial support can help domestic companies pay for their investments or charge lower prices.

Trade protection has rarely if ever been successful when used alone, but in combination with domestic policies it can be a powerful tool. A protected home market can enable domestic firms to catch up with more advanced foreign companies without having to compete with them for domestic customers. Profits in a protected home market can bankroll forays into export markets at low prices, R&D, and investment in worker training and equipment. In the short term, foreign producers could probably meet these low prices; but in the long term, foreign firms not similarly supported can lose market share and the revenues to fund new investments. Of course, protection can easily go astray, leading to an industry ill-suited to international competition, but when managed properly it can aid a nation's economic development.

Other countries' domestic programs and market protection have often delivered a one-two punch to U.S. industries. For the most part, the U.S. Government does not have comparable proactive programs to promote its own industries. U.S. trade policy plays out by noticing some of the advantages foreign firms enjoy, and then trying after-the-fact to eliminate or offset them, usually after substantial delay and often incompletely. Important foreign market barriers often persist for years, despite U.S. attempts to eliminate them. While some advantages enjoyed by foreign firms are recognized by U.S. dumping and subsidies law, various problems prevent or limit redress even in deserving cases. These problems include the expense required to prepare a petition and fight a legal case, the time it takes to conduct investigations, ways by which foreign firms circumvent duty orders, the interpretation of the injury requirement so as to inhibit timely relief, and the law's failure to recognize the impact of many subsidies.

U.S. policy thus puts important industries at risk. No matter how hard U.S. firms work, under current conditions they might not be able to compete with foreign industries backed by their governments.

Other aspects of U.S. policy are also ineffective in promoting the competitiveness of U.S. industry. While many foreign governments' procurement policies are attuned to fostering national industries, U.S. procurement policy is not. The Commerce Department's export promotion programs, while useful, are small and ineffective compared with programs in other countries. Export financing by the Export-Import Bank of the United States is sometimes less attractive than that offered by other countries' export financing agencies. Finally, U.S. national security export controls unduly hinder high-technology exports; while many controls truly are necessary for national security, some are not.

EUROPE AND THE SINGLE MARKET

The United States is not alone in facing questions of what to do about lagging industries and technologies. The nations of the European Community, individually and together, have a long record of attempts to use industrial policy, and with few real successes in past attempts, are launching a new initiative. Known as the Single Market, or, after the proposed date of its inception, Europe 1992, the initiative is really a wide variety of new policies and agreements broadly aimed at increasing European unity, improving technology, and increasing competitiveness.

Unity has been an elusive goal for Europe. The first step was taken with the Treaty of Rome in 1957, but progress toward true harmony was slow and painful. In 1985, the Commission of the European Communities (CEC) proposed a set of some 300 specific policy actions that would be needed to eliminate barriers to movement of goods, services, people, and capital throughout the 12 nations of the EC.[55] For several reasons, one of the most important being determination to escape the economic stagnation that had bedeviled Europe for more than a decade, the CEC adopted the 1985 White Paper, and progress toward implementing the 300 specific resolutions began. Even though progress was immediate and rapid, the history of past disappointments led many American analysts to discount it for several years. Now, however, it is obvious that the EC will have some kind of single market in place at least by the end of 1992, although there will likely be some unfinished items still on the agenda. Significant changes in European economic activity are very possible. How significant? And what does it mean for the United States?

Nearly everyone expects that removing sources of commercial friction among the 12 EC nations—impediments to movement of goods, people, services, and capital—will mean faster growth in the GNP of the European Community. The range of estimates of the increase in growth is wide. The closest thing to an official estimate of the EC is a report done in 1988 (known as the Cecchini report), which estimated gains at 4.3 to 6.4 percent of GDP accruing over a 6-year period, or up to 1 percent additional growth in GDP each year. Another 2.5 percent (over the 6 years) is possible if appropriate accompanying macroeconomic policies are added, according to this estimate. The Cecchini report has been hailed as an impressive technical work, but its growth estimates are also regarded as optimistic.[56] In contrast, the gains in GDP from the elimination of tariffs on industrial products among Common Market countries in 1968 were on the order of 1 percent, total.[57]

What this means for the United States, in the short or long run, is murky. Additional growth, even if it were substantially below the levels estimated by the Cecchini report, would ordinarily mean increased opportunities for U.S. firms to sell goods to and produce goods in Europe. The former (increased exports) would further the national interests of the United States directly; the latter only indirectly, to the extent of contributing a bit to the prosperity of firms headquartered here. But the Cecchini report also makes it clear that some of the added growth in Europe is expected to come at the *expense* of imports from outside the EC; the Cecchini growth forecasts assume a reduction of imports from outside the EC by 7.9 to 10.2 percent.[58] Whether there will be growth in Europe due to factors not anticipated by the Cecchini team, and whether these increase the possibilities for U.S. exports, is simply not clear. Most of the fears that EC 1992 would be a "Fortress Europe" have been put to rest, but there are a few signs of increasing protectionism in Europe.

Two areas where Europe has taken specific steps that limit imports are in automobile trade and semiconductors. The former is not expected to have any significant negative impact on American exports; most U.S. autos sold in Europe are manufactured there already. The story is different for Japanese producers. The other area, semiconductors, could be more problematic for the United States. A change in the rule of origin for semiconductors[59] and a stiff existing tariff on imported semiconductors favor producing in Europe to exporting. This may not have a detrimental effect on companies that already own wafer fabrication plants there, or on the large, rich Japanese producers, but smaller American producers without existing plants in Europe are faced with the painful choice of losing European markets or making expensive investments there. Certainly, the change in the rule of origin makes it more difficult for the United States to export semiconductors to Europe.

There are also developments, such as the liberalization of European government procurement, that could open new markets to non-EC firms, although it is not likely that this will mean much in the way of increased exports. Most of the explicit liberalization of trade is intra-EC. In the short run, then, we would expect few major changes in U.S.-EC trade as a result of the single market.

But what about the long run? One of the aims of EC 1992 is to make European firms more competitive with American and Japanese firms. The single market may contribute somewhat to that by enabling European firms to achieve new economies of scale in a market that will have about the same GNP as the United States. Another contribution could come from the Framework Program and EUREKA. These two programs, the first an EC program and the second a program with 19 members (all the EC countries are members, as is the EC itself), fund R&D intended to improve civilian industrial competitiveness on an impressive scale, by U.S. standards. The third Framework Program (1990-94) is funded at ECU 5.7 billion, and EUREKA projects announced between 1985 and 1990 came to ECU 7.4 billion. At a rough estimate, public funding of European cooperative research in both the Framework and EUREKA programs comes to about $2 billion per year.[60]

The largest parts of the Framework Program, ESPRIT and RACE, are aimed at microelectronics, computer, and telecommunications technologies (including services and software as well as hardware). BRITE is a large program that funds R&D in products and processes to improve basic manufacturing. Other programs address technology development in many areas: medicine and health, energy, advanced materials, biotechnology, agriculture, and road transport efficiency and safety.

Both the Framework Program and EUREKA projects encourage cross-border collaboration to promote unity and exchange of scientific and technological information in Europe, and the resulting enthusiasm for cross-border collaboration is due, in no small part, to this encouragement. Whether this increased international exchange and collaboration, or the money spent on developing new technologies, will contribute significantly to European competitiveness is questionable. It is probably too soon to judge most of the programs, but those that have been going for awhile, and several past efforts at cross-border collaboration in technology, have produced few unambiguously successful results.

JAPAN

Japan is the economic phoenix of the postwar period. Throughout the nearly five decades following the war, its growth of GNP and productivity have consistently been higher than in the rest of the developed world. That it should be so was by no means obvious in the first decade after the end of the war. Japan was desperately poor, short of most raw materials, and faced labor strife. Now, one of the biggest problems Japanese bureaucrats face is how to contain the robust productive power of its premier corporations enough to avoid exacerbating trade disputes.

The Japanese Government has long used industrial policy to push its economy toward more high-value-added, knowledge-intensive industries that use more highly skilled labor and fewer natural resources. The primary tools are financial aid, government sponsorship of price, investment, and R&D cartels, and protection of the domestic market. These policies were instrumental in improving competitiveness in industries like steel, motor vehicles, semiconductors, and computers.

A few caveats are in order. The impression is often given that Japanese policies alone are responsible for Japan's economic success, and that the record of success is unblemished. In fact, Japan's policies were creative and innovative but they would have been much less effective in a society with less well educated people that placed lower value on hard work and ceaseless pursuit of improvement. Japan's culture, with its emphasis on achieving consensus, and on the performance and interests of groups rather than individuals, played a role, although the prominence given to cultural explanations of Japan's success in the popular literature is often overdone. There are also several examples of failure in Japanese industrial policies. For instance, the long-term goal of promoting an indigenous large civilian air transport industry has remained elusive, and MITI's expectations have been scaled back considerably.

There is widespread disagreement, at least among American analysts, about the overall effect of Japanese industrial policy on Japan's national income and standards of living. Japanese consumers have long been able to live less well than American

consumers on an equivalent amount of income, in part because of policies that sheltered many industries from foreign competition. Some of those policies, in turn, were made to foster industrial development; the inference that Japanese consumers pay for Japan's industrial policies is quite correct. But the tradeoff is not just between Japanese industry and consumers; it is also a sacrifice of short-run gratification in favor of enhanced prospects for long-run growth. Even as Japanese standards of living and wages approach those of the richest nations, there are few signs of impending stagnation, and it is likely that faster growth of Japanese living standards will continue, surpassing ours.

That does not mean that Japanese policy remains the same as always. The hand of the government in directing industrial development is considerably less heavy than it was during the high-growth period (which ended in 1974, with the first oil shock). Japan's government has liberalized financial markets and consumer credit, reduced formal, quantitative import barriers, liberalized foreign investment, and reduced the number of cartels. Some have interpreted this as proof that Japan's economy is a modern, capitalist, free-market one along the lines of America, Canada, Germany, or Great Britain. Yet Japan's trade patterns remain peculiar by the standards of other developed countries; manufactured imports are quite low, and a strong preference remains for adding as much value as possible in Japan. Japanese direct investment abroad is more oriented to exports than the direct investment of other developed nations, and it is an outlier among developed nations in that foreign direct investment plays a much smaller role in its own economy. Many in America and Japan argue that all this is simply because foreign exporters or investors are not diligent enough; their products are inferior or their knowledge of Japanese business practice is weak. Some of that is true, but it is not the whole story.

Japan's Government is still actively involved in creating an advantageous environment for Japanese business. The computer industry was targeted for development nearly three decades ago, and within the past 5 years has come of age; many Japanese computers from mainframes to laptops are now as good as or better than American models. That payoff is the result of three decades of company diligence and experimentation, combined with tax incentives (general and specific), R&D funding in strategic areas, subsidized leasing, and market protection.[61] Policies changed over time, in response to different industry needs, and even now, with competitive and technological advantage increasingly weighted on the side of the Japanese computer makers, policies to support specific segments continue. One such area is supercomputers, where Japanese Government support has continued through the 1980s and into the 1990s. Some support comes in the form of funding for research consortia. From 1981 to 1989, the Japanese Government spent 18.2 billion yen (about $121 million) on the High Speed Computing System for Scientific and Technological Uses Project, aimed at producing a machine with a speed of 10 Gigaflops. NTT, the Japanese telephone company, also supports supercomputer technology development in its own supercomputer project, and several public and private projects are exploring parallel and massively parallel processing.

Another important element of the strategy is procurement. Until very recently, American supercomputers were superior to Japanese supercomputers, yet while U.S. machines only were bought and installed in America and Europe, they were a small share of Japanese purchases. In 1987, for example, Cray and Control Data, American supercomputer makers, accounted for 73 percent of installed supercomputers in the world; Japanese companies for 27 percent, which consisted entirely of sales within Japan. Moreover, the Japanese companies Fujitsu, NEC, and Hitachi accounted for 87 percent of all Japanese installations, and Cray for only 13 percent. In part, that could be attributed to the Japanese preference for buying goods from and doing business with other members of *keiretsu*, but American supercomputers had a far more difficult time in the Japanese public sector than in the private sector. A few Japanese private companies bought Cray machines because they were better and faster, and buying an inferior Japanese machine would have been a real handicap; in the public sector, however, procurement was almost exclusively of Japanese machines. The Japanese Government apparently was determined to provide Japanese companies with a secure market while they worked hard to catch up to or surpass Cray's technology.

There are many who regard such practices as unfair or underhanded. In fact, they are logical, reasonable things for governments to do; Japan is hardly alone among industrialized countries in using the power of public procurement to foster domestic

business and competitiveness. The story is not told for the purpose of castigating Japanese policy, but to illustrate that policies designed to create competitive advantages for Japanese firms (and compensate for the advantages of foreign firms) are not relegated to Japanese history. MITI, and other Japanese Government agencies that are *genkyoku* (sections of the bureaucracy with primary responsibility for developing and supervising policies for an industry), may have less ability to manipulate industries and the economy than they once had, but they still wield considerable power.

Is Japan at a crossroads? Legions of writers have said so; one of the most popular themes of current writing on competitiveness is how much and how fast Japan is changing. In a sense, Japan has never stopped changing; policies that supported a particular industry or activity were shifting in the 1950s and 1960s as well as the 1980s. But the implicit corollary to the "Japan is changing" genre is also that it is becoming more like us in ways that will make its industrial performance more like ours. At best, this is unproven; more likely it is a delusion. Japan's government and private sector are still working, independently and together, to improve the competitive performance and market share of Japanese companies in a wide range of industries. They will probably succeed.

INDUSTRIAL POLICIES IN TAIWAN AND KOREA

Like Japan, Korea and Taiwan have used industrial policies to encourage the development of high-technology, high-wage industries. They, too, have been successful. Their successes indicate that industrial policies can contribute to industrial competitiveness under differing circumstances—in other words, that Japan's industrial policies were not mere adjuncts to a culture that provides hothouse conditions for business.

The Republic of Korea and the Republic of China (referred to throughout this summary as Korea and Taiwan) have advanced remarkably fast, in comparison to developed and developing nations, and especially compared to what most observers expected. In 1965, Taiwan was the world's 28th largest exporter of manufactured goods; in 1986, it was 10th. Korea moved up from 33rd to 13th. In 1989, Taiwan and Korea were, respectively, the fourth and fifth largest suppliers of manufactured goods to the U.S. market. Both nations are still poor compared with the developed world—their combined GDP is 1.5 percent of the free world's GDP—but they have done remarkably well nonetheless at moving from manufacture of light industrial products requiring large contributions from low-wage labor to compete, to high-technology industries like computers and semiconductors. Taiwan is the world's 10th largest producer of machine tools, with particular strength in low-end numerically controlled machines; Korea is the first developing country since Japan to make a strong debut in world automobile manufacture.

Korean and Taiwanese industrial policies share many similarities, but there are important differences as well. They are similar in that they rely on long-term planning—overall visions of the directions of economic growth and development—and use industrial targeting in addition to broader measures to encourage industrial activity generally. They educate their people superbly and share a cultural commitment to hard work. Finally, they both forced their companies to compete with the most proficient of world competitors, using competition abroad to provide the impetus for cost reduction and productivity improvement, while shielding them from competition at home. In Korea in particular, the protected home market was also used to make firms compete more effectively; the ability of firms to import needed inputs and machinery depended on their export performance.

The differences are also interesting. The Taiwanese market has long been more open than Korea's and the industrial structure much less concentrated. Taiwanese firms have performed well across a broader range of industries than Korean firms, reflecting the choice of market niches that rely on standardized technologies that can be purchased and used effectively by small firms. Korea has organized production into large, conglomerate firms that have very few competitors at home and have performed well in many sectors where the economies of scale that large firms can gain are advantages, such as motor vehicles, consumer electronics, semiconductors.

Both countries have had setbacks. Some attempts to develop industries or rationalize production failed, as was the case in Japan. But Japan's success has also made the world a more difficult place for Taiwan and Korea; developed countries, afraid of what could happen to their own industries if

"another Japan" appeared, have been much less tolerant of Korean and Taiwanese policies like controlling currency values, protecting their own markets, and loose protection of intellectual property than was true for Japan. Both countries have, in response to increasing pressure from the United States and other trading partners, liberalized controls over their markets and currencies, and permitted more imports. Their own success has made it more difficult for them to pursue the policies responsible for success. Whether they can continue to develop, and raise their living standards above levels that are still only at the high end of poverty by the standards of developed nations, will probably depend as much on the performance of American and European economies as on their own. If America and the EC are successful in getting their own manufacturing back on track, by whatever standards they adopt, the world will be a more amenable place for developing countries, including Korea and Taiwan. If, on the other hand, American and European manufacturing continue to lose competitiveness, and only Japan gains, things could be different. Japan's role in promoting world development is now larger than America's, but would Japan be able to compensate for the retaliatory and self-protective policies likely to grow if American and European industries continue to lose competitiveness? It is possible, but perhaps unlikely; Japan, too, is concerned about the economic success of her neighbors, and continues to pursue industrial policies of her own in response to the challenge of these newly industrializing countries.

GOVERNMENT SUPPORT OF LARGE COMMERCIAL AIRCRAFT

More than most other civilian industries, the large commercial aircraft industry owes its existence to government policies in whatever countries it exists. The U.S. aircraft industry[62] is the largest in the world, and is the largest single trade-surplus category in America's international accounts; in 1990, the United States ran a $13 billion surplus in commercial transport aircraft and parts.[63] This was not always so. For a few years in the early part of this century, European producers were more advanced technologically; without substantial support from the government, the U.S. aircraft industry might not have gotten off the ground. Today, government support is second to corporate strategy as a determinant of the strength of the industry in the United States, and it is an extremely important contributor to the European aircraft consortium, Airbus Industrie. Although support for aircraft is regarded by some as one of the more prominent failures of Japanese industrial policy, the Japanese are hardly out of the race yet, and government supports are an important reason. Government is a major player, but its role varies widely in America, Europe, and Japan.

In the United States, most of the government support for the aircraft industry has been indirect, a byproduct of defense programs. Though their contributions have decreased considerably, military R&D and contracts for production of military aircraft are the largest government contributions to aircraft industry competitiveness. To be sure, civilian industrial breakthroughs have also given DoD programs many boosts as well; the contributions of military and civilian developments to modern jet engines, for example, are tough to disentangle. Also, military business does not always follow the business cycle, giving aircraft and engine companies some ability to maintain expensive R&D programs and staffs through economic downturns to which this industry like so many other durable goods industries, is particularly vulnerable in recessions. On the other hand, on the occasions when government spending on defense aircraft and NASA programs declines during an economic recession, the damage to the industry is substantial.

The U.S. Government also has contributed to the civilian aircraft industry through nonmilitary programs. NASA is spending $800 million in fiscal year 1991 on R&D that can contribute to the civilian aircraft industry. Still, there are problems; NASA's programs are not designed to contribute most effectively to competitiveness, but instead serve a range of other purposes—understanding of basic scientific principles of aerodynamics and materials, and the like. As a result, the programs make a smaller contribution to competitiveness than they could, dollar for dollar, if they were designed to improve competitiveness. Finally, military programs have become much more burdensome, and less of a contribution to civilian industrial needs, in the last decade. Intricate and intrusive DoD procurement rules, and changes in the funding of R&D, have shifted more of the burden of developing technologies for civilian aircraft to the companies' own coffers, and diminish the usefulness of military contracts.[64] At the same time, military purchases are declining sharply.

Whether government policies designed to serve other purposes could have similar beneficial effects on other industries is quite doubtful, and reliance on serendipitous externalities is not likely to be the salvation of American manufacturing. The aircraft industry is a special case in several ways. Its formidable development and R&D costs, capital intensity, strong scale economies, and heavy reliance on accumulated experience of integrating production of millions of components make it different from most other industries. Electronics industries share some of these attributes (high development and R&D costs, capital intensity, and in some sectors, scale economies that also make it hard for more than a very few producers to make a profit), but differs in other respects (the half-life of commercial technology is generally far shorter in electronics than in aircraft, for example). Several decades ago, the government employed policies similar to ones that it uses now in the aircraft industry to jump-start a U.S. semiconductor industry, and with similar results for U.S. competitiveness.

The governments of some European countries and Japan are less willing than the U.S. Government to leave competitive outcomes to chance in the aircraft industry. France, Germany, Great Britain, and Spain have contributed billions of dollars over more than two decades to Airbus Industrie, a consortium of four companies (Aerospatiale, Deutsche Airbus, British Aerospace, and CASA), to enable them to produce large commercial air transports that would compete directly with the products of Boeing and McDonnell Douglas. Support for Airbus is hard to pin down, since the company itself keeps no records on the amounts contributed by the governments, but the low-cost loans given to the consortium members over the years have enabled the companies to overcome the substantial barriers posed by high development and capital equipment costs and long, uncertain payback periods. While the investments made in Airbus have, according to the best estimates, not been repaid and may never be fully recompensed, there are benefits: increased competition, which forced Boeing and McDonnell Douglas to lower prices; the direct benefits of high-wage jobs and increased exports; and, indirect benefits consisting primarily of spinoffs of technology. Considering these benefits, so far the four European governments seem to believe the investment in Airbus is worth what it costs. Whether such a belief would stand up to the rigors of a standard economic benefit-cost analysis is much less certain.

Japan's Government has supported its aircraft industry for more than three decades. The industry was targeted for special support and development in MITI's planning documents since the 1970s, yet Japan has never achieved MITI's original goal for the industry: to become an independent producer of large commercial jet transports. For this reason, the aircraft industry is often used as an example of a failure of Japanese industrial policy, and occasionally as an example of the eventual fate of all attempts at industrial policy. Closer examination reveals that neither the policies nor the industry are such failures as some of the more deprecatory analyses indicate. In 1989, Japanese companies produced commercial aircraft-related products worth $1.2 billion,[65] and exported half of it. Japanese companies have become major partners in new jet engine production, and continue to progress in other segments of the business. Their accomplishments owe much to Japanese industrial policies; the fact that the aircraft industry has not moved ahead as much or as fast as many other targeted industries is not an indictment of those policies. Instead, the aircraft industry illustrates the limitations of industrial policy in the face of formidable obstacles, including Japan's unique constitutional limitations over much of the postwar period on the production or development of military aircraft.

1 We cannot be more precise than merchandise trade; figures for U.S. share of world manufactured exports and imports are not available. However, the majority of merchandise trade is in manufactured products.

2 The World Bank, *World Tables: 1989-90 Edition* (Baltimore, MD: The Johns Hopkins University Press, 1990).

3 1982-84 dollars.

4 Real weekly wages have not fallen as much as real hourly wages, because hours worked per week have increased.

5 U.S. Department of Labor, Bureau of Labor Statistics, "Comparative Real Gross Domestic Product, Real GDP Per Capita, and Real GDP Per Employed Person, Fourteen Countries, 1950-1989," unpublished data, p. 8.

6 The World Bank, *World Tables*, op. cit., pp. 8-9 and pp. 328-329. Figures are in 1980 U.S. dollar terms.

7 Robert Heilbroner, "A Tune-Up For the Market," *The New York Times Magazine*, Sept. 24, 1989, p. 61.

8 Ibid., p. 75.

9 This is OTA's conclusion, based on studies of Korean, Taiwanese, and Japanese industrial policies of the postwar period (see chs. 6 and 7). Many analysts disagree that these nations' industrial policies were either effective or significantly responsible for their economic success. On the anti-industrial policy side, see, e.g., Gary Saxonhouse, "What Is All This About 'Industrial Targetting' in Japan?" *The World Economy*, vol. 6, No. 3, 1987, pp. 253-273; Philip Tresize, "Industrial

Policy Is Not the Major Reason for Japan's Success," *The Brookings Review 2*, spring 1983, pp. 13-18; Richard Samuels, *The Business of the Japanese State: Energy Markets in Comparative and Historical Perspective* (Ithaca, NY: Cornell University Press, 1987). Among those who think that Japan's industrial policy had an important effect on its growth, see Ira Magaziner and Thomas Hout, *Japanese Industrial Policy* (London: Policy Studies Institute, 1980); Chalmers Johnson, *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975* (Stanford, CA: Stanford University Press, 1982); John Zysman, *Governments, Markets, and Growth: Financial Systems and the Politics of Industrial Change* (Ithaca, NY: Cornell University Press, 1983); M. Aoki, *Information, Incentives, and Bargaining in the Japanese Economy* (Cambridge: Cambridge University Press 1988); R. Lawless and T. Shaheen, "Airplanes and Airports: The Subtle Skill of Japanese Protectionism," *SAIS Review*, fall 1987, pp. 101-120; K. Yamamura, "Caveat Emptor: The Industrial Policy of Japan," in P. Krugman, *Strategic Trade Policy and the New International Economics* (Cambridge, MA: The MIT Press, 1986).

10 For instance, Japan recently signed a voluntary restraint agreement (VRA) with Korea, under which Korean exporters of apparel agreed to restrain their exports to Japan. See "Japan, South Korea Work Out Knotty Knitwear Dispute," *Japan Economic Journal*, Feb. 11, 1988.

11 Daniel I. Okimoto, *Between MITI and the Market: Japanese Industrial Policy for High Technology* (Stanford, CA: Stanford University Press, 1989), p. 47.

12 Ibid., pp. 38-48.

13 Ibid., p. 49.

14 Guy Routh, *The Origin of Economic Ideas*, 2nd ed. (Dobbs Ferry, NY: Sheridan House, 1989), passim.

15 For a more complete discussion of the role of capital costs on industrial performance, see ch. 2 of the full report and U.S. Office of Technology Assessment, *Making Things Better: Competing in Manufacturing*, OTA-ITE-443 (Washington, DC: U.S. Government Printing Office, February 1990), ch. 4 passim.

16 An eloquent explanation of how these strategies worked is in Robert Wade, *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization* (Princeton, NJ: Princeton University Press, 1990).

17 Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, *Industrial Policy of Japan* (Tokyo: Academic Press, 1988), p. 7.

18 See ch. 6 of the full report for more discussion of Japanese industrial policies.

19 The Framework Program is a set of EC-funded R&D programs. EUREKA is a publicly coordinated and supported R&D effort of 19 European countries, including the 12 members of the EC. See ch. 5 of the full report for discussion of the single market, the Framework Program, and EUREKA.

20 Except where noted, this is the definition of industrial policy used in this study.

21 See ch. 8 of the full report and vol. II for additional discussion of the aircraft manufacturing industry in the United States, Europe, and Japan.

22 Including salaries of employees, R&D, and construction of facilities.

23 Unpublished budget figures, NASA.

24 Marie Anchordoguy, "The Nature and Effectiveness of Japan's Postwar Industrial Policy," contractor report for the Office of Technology Assessment, February 1990.

25 The World Bank, *World Tables* (Washington, DC: The World Bank, 1989).

26 Kenneth Flamm, "Policy and Politics in the International Semiconductor Industry," Paper Presented to the SEMI ISS Seminar, Newport Beach, CA, Jan. 16, 1989.

27 Material about the STA in this paragraph is drawn from Flamm, ibid.

28 This refers to both the formal STA and the side letter that specified that foreign shares of Japan's semiconductor market should grow.

29 The following account is drawn from Thomas Howell, Brent Bartlett, and Warren Davis, *Semiconductors and Government Industrial Policy in the 1990s* (Washington, DC: Dewey Ballantine, draft in progress), pp. 126-139.

30 There is some conflict on this point. MITI maintains that the foreign share is over 17 percent, while the U.S. Government and industry estimate the foreign share to be between 13 and 14 percent. The difference is that MITI counts (while U.S. Government and industry do not): 1) captive sales—i.e., in-house sales of a chip of a type that is not offered for sale to outsiders and 2) private label sales of a chip made by a Japanese firm with a U.S. firm's label.

31 Keiretsu are groups of Japanese companies that do much of their business within the group and hold significant amounts of each other's stock. See ch. 6 of the full report for additional discussion.

32 Edward J. Lincoln, *Japan's Unequal Trade* (Washington, DC: The Brookings Institution, 1990), pp. 62-67.

33 *Budget of the United States: Fiscal Year 1992*, Part Two, p. 47.

34 U.S. Department of Commerce, Technology Administration, *Emerging Technologies: A Survey of Technical and Economic Opportunities* (Washington, DC: 1990); and Council on Competitiveness, *Gaining New Ground* (Washington, DC: 1991)

35 Not to be confused with two other groups with similar names: the non-statutory Council on Competitiveness in the office of Vice President Quayle, which is concerned with the effects of Federal regulation; and a private Council on Competitiveness, composed of chief executive offices from industry, academia, and labor.

36 These bills include S. 121, as reported by the Senate Committee on Governmental Affairs in the 98th Congress; S. 1365 in the 99th Congress; H.R. 1338 and H.R. 2135 in the 100th Congress; and H.R. 1274 in the 101st Congress.

37 S. 1978 in the 101st Congress; S. 1233, as reported by the Senate Committee on Governmental Affairs in the 100th Congress.

38 Robert N. McCauley and Steven A. Zimmer, "Explaining International Differences in Capital Costs," *Federal Reserve Bank of New York Quarterly Review*, summer 1989, pp. 7-28. See also OTA, *Making Things Better*, op. cit., ch. 3.

39 OTA, *Making Things Better*, op. cit., p. 58.

40 19 U.S.C. 2411-2420.

41 19 U.S.C. 2251-2254.

42 U.S. Trade and Development Program, 1990 Annual Report, pp. 27, 29, 55-61.

43 50 U.S.C. App. 2401-2420. This Act's authorization lapsed as of Oct. 1, 1990, but President Bush continued its provisions in force by invoking the International Emergency Economic Powers Act, 50 U.S.C. 1702. See Executive Order 12730—Continuation of Export Control Regulations, Sept. 30, 1990.

44 This option is termed strategic technology policy and described in detail in OTA, *Making Things Better*, op. cit., pp. 71-88.

45 S. 1233 in the 100th Congress; H.R. 3838 and S. 1978 in the 101st Congress.

46 S. 1191 in the 101st Congress.

47 Council on Competitiveness, *Gaining New Ground*, op. cit.

48 National Advisory Committee on Semiconductors, *Toward a National Semiconductor Strategy*, Second Annual Report (Arlington, VA: 1991), p. 15.

49 John W. Rutter, "Direct Investment Update: Trends in International Direct Investment," U.S. Department of Commerce, International Trade Administration, September 1989. The stock of investment given here is the position of foreign direct investors, or the value of the foreign investors' equity in and loans to offshore affiliates. For the United States, a foreign direct investor is one that owns or controls at least 10 percent of a company's voting stock (or an equivalent amount in an unincorporated enterprise).

50 1988 is the latest year for which data are available.

51 The latest figures are, unfortunately, for 1982; that year, foreign affiliates of U.S. parent companies accounted for less than 9 percent of the companies' total R&D.

52 In the late 1970s, manufacturing affiliates of foreign parents had much higher investment in plant and equipment, as a percent of sales, than U.S. manufacturers; by the early 1960s, most of the difference had disappeared. U.S. affiliates of foreign multinationals also pay slightly higher compensation than American companies on average, but that is due to relatively heavy concentration of investment in high-wage industries, like banking, and not to higher wages in comparable establishments.

53 In the past, the trade surplus generated by U.S. direct investment abroad was also substantial, but it has dwindled. In 1988, U.S. parent companies were associated with a merchandise trade surplus of only about $8 billion.

54 It is important to remember what makes a firm "foreign." Obviously, any wholly owned subsidiary of a foreign firm qualifies. In the United States, a firm is counted as an affiliate of a foreign parent if one foreign parent company controls 10 percent or more of its voting stock, or an equivalent stake in an unincorporated enterprise.

55 The 12 members are Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom.

56 See, for example, Merton J. Peck, "Industrial Organization and the Gains from Europe 1992," Vittorio Grilli, "Financial Markets and 1992," Richard N. Cooper, "Europe Without Borders," and Rudiger Dornbusch, "Europe 1992: Macroeconomic Implications," all in William C. Brainard and George L. Perry (eds.), *Brookings Papers on Economic Activity 2* (Washington, DC: The Brookings Institution, 1989), pp. 277-381 passim. Peck, for example, says, "It is important to emphasize this overoptimism, given the significance of the report both as a work of economic advocacy and as an impressive scientific study." Peck, p. 278.

57 Peck, ibid., p. 277.

58 Dornbusch, op. cit., p. 353.

59 While it is not a statutory requirement, most nations distinguish foreign from domestic goods by a rule of origin that states that the good comes from the nation where the last substantial transformation is made. The EC used this rule for semiconductors for many years, but recently changed it to state that semiconductors originated where the *most* substantial transformation, which the EC defines as diffusion, is made.

60 The ECU 5.7 billion for the Framework Program is all public money; it is generally matched by the projects' participants, except for certain nonprofit organizations such as universities, which can receive up to 100 percent of project costs from the European Community. EUREKA is primarily funded by the private sector; less than 10 percent of its funding is public money according to the U.S. International Trade Commission. A rough calculation, assuming that 10 percent of EUREKA costs are public and that both programs spend about the same amount of money each year, yields annual public funding of cooperative research amounting to ECU 1.6 billion, or about $1.9 billion. Source of funding numbers is U.S. International Trade Commission, *1992: The Effects of Greater Economic Integration Within the European Community on the United States: Second Followup Report*, USITC Pub. No 332-267 (Washington, DC: September 1990), pp. 16-6 and 16-10.

61 See, for example, Marie Anchordoguy, "Japanese Policies for the Supercomputer Industry," contract report for the Office of Technology Assessment, February 1991; Marie Anchordoguy, *Computers, Inc.: Japan's Challenge to IBM)* (Cambridge, MA: Council on East Asian Studies, Harvard University, 1989); and Kenneth Flamm, *Targeting the Computer: Government Support and International Competition* (Washington, DC: The Brookings Institution, 1987).

62 Throughout this assessment, the large commercial aircraft industry will be referred to as the aircraft industry. Only when specified does the term refer to all segments, including military aircraft.

63 This is unusually high; in 1990, a strike at British Aerospace delayed deliveries of some Airbus aircraft purchased by U.S. airlines. Aerospace Industries Association, "1990 Year-End Review and Forecast—An Analysis," addendum to *Aerospace Facts and Figures 90-91* (Washington, DC: 1990).

64 This should not be read as an unqualified indictment of military procurement and R&D contracts. The changes over the past decade were made for understandable reasons—i.e., avoiding fraud and reducing costs—and this study did not look into how the changes have performed in doing what they were designed to do. For further information on that topic, see U.S. Congress, Office of Technology Assessment, *Holding The Edge: Maintaining the Defense Technology Base*, OTA-ISC-420 (Washington, DC: U.S. Government Printing Office, April 1989).

65 The conversion rate is ¥130 to $1.

NOTE: Copies of the report "Competing Economies: America, Europe, and the Pacific Rim" can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325, GPO stock No. 052-003-01260-0.

U.S. GOVERNMENT PRINTING OFFICE : 1991 O - 292-885 QL:3

Office of Technology Assessment

The Office of Technology Assessment (OTA) was created in 1972 as an analytical arm of Congress. OTA's basic function is to help legislative policymakers anticipate and plan for the consequences of technological changes and to examine the many ways, expected and unexpected, in which technology affects people's lives. The assessment of technology calls for exploration of the physical, biological, economic, social, and political impacts that can result from applications of scientific knowledge. OTA provides Congress with independent and timely information about the potential effects—both beneficial and harmful—of technological applications.

Requests for studies are made by chairmen of standing committees of the House of Representatives or Senate; by the Technology Assessment Board, the governing body of OTA; or by the Director of OTA in consultation with the Board.

The Technology Assessment Board is composed of six members of the House, six members of the Senate, and the OTA Director, who is a nonvoting member.

OTA has studies under way in nine program areas: energy and materials; industry, technology, and employment; international security and commerce; biological applications; food and renewable resources; health; telecommunication and computing technologies; oceans and environment; and science, education, and transportation.